

1.5. 1 Surgeon General's Office

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FINAL REPORT OF THE PREVENTIVE MEDICINE OFFICER

OFFICE OF THE SURGEON

MEDITERRANEAN THEATER OF OPERATIONS

UNITED STATES ARMY

1 January - 31 October 1945

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HEADQUARTERS MEDITERRANEAN THEATER OF OPERATIONS UNITED STATES ARMY Office of the Surgeon APO 512

2 November 1945

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SUBJECT: Final Report of the Preventive Medicine Officer.

TO : Surgeon, MTOUSA.

Submitted herewith is final report of the preventive medicine officer, Office of the Surgeon, MTOUSA, covering the period 1 January - 31 October 1945.

/s/Hugh R. Gilmore
HUGH R. GILMORE,
Colonel, MC,
Preventive Medicine Officer.

461. lst Ind. HEADQUARTERS MTOUSA, OFFICE OF THE SURGEON, APO 512, 3 November 1945.

TO: The Surgeon General, U. S. Army, Washington 25, D.C. Approved.

/s/E. Standlee
E. STANDLEE,
Colonel, M.C.,
Surgeon.

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Final report of preventive
medicine officer, office of
the surgeon, MTOUSA (dup)

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TABLE OF CONTENTS

		Page
I	GENERAL	1
II	PLANS	3
III	MILITARY IMPORTANCE OF DISEASE AND INJURY	5
IV	GENERAL EXPERIENCE	9
V	RESPIRATORY DISEASES	11
VI	INTESTINAL DISEASES	15
VII	INSECT-BORNE DISEASES	19
/III	MISCELLANEOUS CONDITIONS	25
IX	SPECIAL TOPICS	31
X	NUTRITION	41
XI	VENEREAL DISEASE	43
	APPENDICES 1 through 33	52



LIST OF APPENDICES

- 1. Respiratory diseases (chart)
- 2. Intestinal diseases (chart)
- 3. Malaria and F.U.O. (chart)
- 4. Venereal disease (chart; "a" through "l"--tables, directives, etc.)
- 5. Jaundice and trench foot (chart)
- 6. Sandfly fever and miscellaneous diseases (chart)
- 7. Non-battle injuries and battle casualties (chart)
- 8. Noneffectives for medical reasons, MTOUSA, 1943-1944-1945 (chart)
- 9. Permanent total losses -- MTOUSA (chart)
- 10. Disease (chart)
- 11. Non-battle injury (chart)
- 12. Battle injury (chart)
- 13. Battle wound (chart)
- 14. Common respiratory diseases (chart)
- 15. Pneumonia, primary (not atypical) (chart)
- 16. Pneumonia, atypical (chart)
- 17. Bacterial food poisoning (chart)
- 18. Common diarrheas (chart)
- 19. Dysentery, unclassified (chart)
- 20. Malaria, vivax, "new" (chart)
- 21. Malaria, vivax, "old" (chart)
- 22. Fever, undetermined origin (F.U.O.) (chart)
- 23. Gonorrhea, "new" (chart)
- 24. Gonorrhea, "old" (chart)

LIST OF APPENDICES (continued)

- 25. Chancroid, "new" (chart)
- 26. Urethritis (cause undetermined) (chart)
- 27. Penile ulcer (cause undetermined) (chart)
- 28. Hepatitis, infectious (chart)
- 29. Mycotic dermatoses (chart)
- 30. Analyses of stool specimens examined 1944 (also 30a and 30b) (charts)
- 31. Omitted [Cultures submitted to the 15th Medical Laboratory (table)]
- 32. Report of malaria-control activities in the Mediterranean Theater of Operations during 1945 (includes 57 illustrations--photographs, maps, charts, figures--and
 - "A Study of Winter DDT House-spraying and its Concomittant Effect on Anophelines and Malaria in an Endemic Area" by Thomas H. G. Aitken, Major, SnC and
 - "Oil Spraying Equipment for the A-20 (Douglas) and PT-17 (Stearman) Airplanes" by William J. Wyatt, Major, SnC)
- 33. MTOUSA safety and accident prevention program

FINAL REPORT OF THE PREVENTIVE MEDICINE OFFICER

OFFICE OF THE SURGEON

MTOUSA - 1945

PREVENTIVE MEDICINE HISTORY

CHAPTER I

General

The troops which landed in North Africa in November 1942 were not well trained in matters of housekeeping and sanitation. This is not said in depreciation of the training which these men had been given, but merely as an explanation for the serious outbreaks of gastro-intestinal disease, malaria and trenchfoot, which occurred in 1943.

The development of high standards of sanitation in an Army in the field is dependent on <u>detailed</u> knowledge of "good housekeeping" which extends down to the lowest echelons. In the United States, people in general have come to take sanitary measures so much for granted that few people realize the importance of chlorination, of pasteurization, of waste disposal, of food inspections, etc.

Until the company and platoon commanders and noncommissioned officers are convinced that water sanitation, food handler examinations, waste disposal, use of repellents, bed nets, etc., are necessary, useful and sensible procedures, it is unlikely that they will adequately carry out the various little steps so necessary for protecting the health of troops. Once the forces saw the results of neglect in the diarrhea outbreak which was almost universal in 1943 and in the serious malaria outbreaks in Sicily, it was no longer necessary to convince anyone of the importance of sanitation. From this time forward, the problem consisted in organization of preventive medicine activities to insure adequate supplies being at the right place at the right time: to maintain a continuing inspectorial system to insure the application of both old and new lessons; to indoctrinate new troops entering the theater; to develop improved methods for preventing disease and to expand the program to encompass many of the numerically less important but still significant diseases.

During 1945 the preventive medicine program has operated smoothly and efficiently. Troops had been well trained in sanitation principles and adequate supplies were available for carrying out all disease control procedures. As a result, disease rates in 1945 were appreciably lower than in 1944 or 1943.

CHAPTER II

Plans

The 1944 experience indicated that the following diseases would be of major importance in 1945:

Malaria Diarrheal Diseases Infectious Hepatitis Trenchfoot Venereal Diseases

Plans to control these diseases were essentially an extension of the 1944 plans into 1945.

The malaria control program was based on the following basic procedures:

- l. Control of mosquito breeding by larviciding, ditching and draining. This work was largely done under the supervision of malaria control units, although troop units were held responsible for their own immediate areas. Airplanes were available for larviciding large areas.
- 2. Destruction of adult mosquitoes by spraying houses and barns with DDT, and by the use of freon bombs.
- 3. Individual protective measures, such as the use of bed nets and insect repellent.
- 4. Suppressive atabrine therapy for troops in malarious areas.

The control of diarrheal diseases centered upon frequent sanitary inspections to insure proper mess and food sanitation; proper disposal of waste; fly control and examination of food handlers to detect carriers of intestinal diseases. The availability and widespread use of DDT was of great importance in reducing the fly population to a minimum.

Since the method of spread of infectious hepatitis is not known, it is difficult to know how to prevent it. However, emphasis was placed on mess sanitation since some evidence exists that the disease is spread by ingesting infectious material.

Plans for preventing trenchfoot centered upon the use of shoe pacs, which had not been available in 1943-44, and on an educational program regarding care of the feet and methods of preventing trenchfoot.

The venereal disease control program was a continuation of the 1944 program plus the use of medical prophylactic platoons to operate prophylactic stations in cities. Late in 1944 condoms were made more readily available to troops by issuing them to units without charge and in such numbers that issue to individuals could be unrestricted. In 1945 the use of the intraurethral injections of a silver salt was stopped. The administration of sulfa drugs with a prophylactic was initiated in 1944.

In reviewing the experience in this theater with preventive medicine measures two important points stand out: (1) It is essential in planning for any campaign to include preventive medicine plans and to impress the importance of these plans upon command. All unitcommanders must be made to realize the importance of carrying out the preventive medicine measures recommended. (2) To carry out preventive medicine measures it is essential that supplies get to troops promptly. These supplies include such items as screening, sprays and sprayers, DDT, diesel oil, Paris Green, and insect repellents. One of the causes of the high diarrhea and malaria rates in 1943 was the early failure to provide troops with fly and mosquito control supplies. These outbreaks in the summer of 1943 impressed upon commanders the importance of sanitation and the necessity for adequate supplies, and, as a result, planning for the invasion of Italy included preventive medicine measures and supplies.

CHAPTER III

Military Importance of Disease and Injury

In assessing the military importance of disease and injury, it is necessary to consider a number of different factors such as:

Morbidity
Noneffective rates
Length of hospitalization
Mortality
Percentages evacuated to the Zone of the Interior
Percentages reclassified from general to limited
service

All important statistics are shown in the attached appendices.

- 1. Morbidity (appendices 1-7). The number of cases and rates for all conditions are shown.
- 2. Noneffective rates (appendix 8). The fact that the percent of disease noneffectives is lower for the first few months of 1943 calls for explanation in the face of the generally higher rates for communicable disease during those months. This is believed to be due to the following:
- (a) Reporting. There is reason to believe that many cases were not reported in the early part of 1943 before the reporting system became thoroughly organized. Also, in the early months of 1943, many United States troops were treated in British hospitals because sufficient United States hospitals were not available in the theater.
- (b) Trench foot, jaundice. These conditions which occurred in epidemic proportions in the latter months of 1943 and early months of 1944 added materially to the early 1944 noneffective rates because of the long period of hospitalization entailed.
- (c) Malaria. The large number of cases of malaria which occurred in the early months of 1944 were chiefly the result of infections incurred in North Africa and Sicily in 1943, which because of suppressive therapy, either became apparent for the first time or which relapsed during the early months of 1944. Until May 1943 troops were not exposed to malaria to any appreciable extent. The same holds true for diarrheal diseases.

- (d) Strength. During 1943 the strength of the theater was increased constantly and at a rapid rate. Hence, fresh troops which had but recently been screened at Ports of Embarkation in the United States were arriving constantly, thus increasing the strength, but adding little to the hospital population during their first weeks in the theater. In 1944-45 the rate of increase in strength was less and consequently the troops were more thoroughly seeded with jaundice and malaria.
- (e) Weather. It seems probable, although no figures are available, that the first period of prolonged combat during bad weather which an army undergoes will bring to the fore these conditions such as arthritis, or psycopathic disorders, which had not previously become manifest under the less vigorous demands of training in the United States. If this istrue, then it is to be expected that this would tend to affect abnormally the noneffective rates during the first winter which a new combat force experiences.
- 3. Length of hospitalization (appendices 10-29). These appendices show the duration of hospitalization and the ultimate disposition for all important conditions encountered in the Mediterranean Theater of Operations (MTOUSA). These appendices are based on data collected from the machine records system operated in this theater.
- 4. Mortality and evacuations to the zone of the interior (appendix 9). This graph illustrates the tremendous importance of the Medical Department in the matter of permanent total losses. It will be seen that nearly half of these losses were carried through medical channels. Considerable discrepancy will be noted between the figures in the following table and the figures used for appendix 9. This is especially true of the missing in action and killed in action figures. In order to keep the chart current it was often necessary to make estimates and these estimates were never corrected, hence the figures in the table are considered more accurate.

Permanent Losses in Theater Strength

		19	43	19	44	1945-1st	45-1st 8 Mos. Totals				
		Cases	%	Cases	%	Cases	%	Cases	8		
Missing i	n Action* Action*	8531 9986	21.0 24.7	18969 32646	20.1 34.7	4183 3083	16.1 12.0	31683 45715	19.8 28.6		
Died Of (Disease Injury Battle Wound	218 709 809	0.5 1.7 2.0	293 1428 2626	0.3 1.4 2.7	160 757 346	0.6 3.0 1.3	671 2894 3781	0.4 1.8 2.3		
	Disease Injury	10568 3139	26.0 7.6	16460 4580	17.5	8869 2964	34.6	35897 10683	22.4		
to ZI (Battle Wound	6446	15.8	16726	17.8	5134	20.1	28306	77.7		
TOTALS		40406		93728		25496		159630	CELL THE CREAT A CLAUSE		

^{*} AG figures as of October 1945.

5. Percentages reclassified from general to limited service. (appendices 10-29) These graphs show the percentages reclassified for all conditions of major importance. Appendices 10-13 are shown because of the comparisons which can be made between Fifth Army Infantry and other elements of the theater. These studies are not based on the entire theater experience and therefore the figures on types of final disposition will vary to some extent from the theater totals taken from 86ab data which are as follows:

	Dis	sease 1	Injury		Rettle	Casualty	CONTRACTOR SAFE
_1943-45 to 1 Sept	Charles and Charles and Control of the Control of t	HARRIS ENCYCHOLOGIC VOICES OF		Percent	MANAGED PROPERTY AND ARCHITECTURE OF THE PROPERTY SECTION AND ARCHITECTURE	Percent	- ALMANDALINA CO
Returned to Duty	755676	95.4	105738	88.6	84141	72.4	(Altoylarada
Evacuated to ZI	35897	4.5	10683	8.9	28306	24.3	
Died	671	°08	2894	2.4	3781	3.2	
Totals	792444		119315	,	116228		AND AND SECURITY OF THE PARTY O

^{** 86}ab.

^{*** 86}f.



CHAPTER IV.

General Experience

The major problems encountered in the theater were:

Malaria
Diarrheal diseases
Venereal diseases
Infectious hepatitis
Typhus fever
Trench foot
Non-battle injuries

Small outbreaks of the following occurred but never constituted a serious problem:

Plague (No cases occurred in United States Troops)
Diptheria
Atypical pneumonia
Poliomyelitis
Infectious polyneuritis (Guillain-Barre Syndrome)
Sandfly fever

The only conditions to which the term epidemic may properly be applied from the theater viewpoint were:

Condition

Period

Diarrheal Disease	Summer = 1943
Malaria	Summer - 1943
Infectious hepatitis	Winter 1943-44 and 1944-45
Trench foot	Winter 1943-44
Venereal disease	Fall of 1943 onward

In addition to these conditions, non-battle injuries exacted an enormous toll in terms of life, disabling injury, man-days lost and equipment destroyed.

These conditions together with many less important conditions will be discussed in the following sections. The figures for November and December 1942 are so unreliable that no attempt will be made to include them in this report. In general, it may be said that no serious disease outbreaks occurred during this interval.



CHAPTER V.

Respiratory Diseases (Appendix 1)

1. Epidemiological experience.

- a. General. The peak incidence of respiratory diseases in the winter of 1944-45 was reached in January 1945 with a rate of 183 per 1000 per annum as compared with a peak rate for 1943-44 of 274 in January 1944. Since January 1945 the rate has declined steadily reaching 60 in July which is lower than any rate previously shown in this theater.
- b. Common respiratory diseases (mild in type) accounted for 34,026 cases cr 78 percent of the total respiratory diseases. (First 8 months of 1945).
- c. Influenza. There were 1101 cases reported for the first 8 months of 1945. It is doubtful whether any of these cases represented true influenza. No epidemic outbreaks that might be attributed to influenza occurred. From time to time in the latter part of 1944 intelligence communications from enemy territory reported influenza being epidemic. These reports were not confirmed. Arrangements were made to obtain blood specimens from patients with suspected influenza in order that tests might be made for influenza. Results showed that true influenza was rare.
- d. Pneumonia (primary, secondary or atypical) was reported 6,016 times. (14 percent of the total respiratory disease cases for the first 8 months of 1945.) These are subdivided as follows:

		Cases
Pneumonia,		850
Pneumonia, Pneumonia,	atypical secondary	5101

Atypical pneumonia showed an increase in 1945 as compared with 1944, In 1944, 3,960 cases were reported for the entire year while in 1945, 5,101 cases are reported to 1 September. This increase, in part, represents better reporting since atypical pneumonia did not appear on weekly statistical health reports till May 1944 although reporting of the disease had previously been required under the "remarks" section of the report. However, there was no doubt an actual increase in the disease. Fifth Army reported several

outbreaks of a disease clinically similar to atypical pneumonia and reported as atypical pneumonia but which differed epidemiologically from atypical pneumonia in that a large number of cases appeared suddenly in an organization. The outbreaks would extend over a period of 3 or 4 weeks and then subside after affecting perhaps 20 or 30 percent of the unit. All outbreaks could be traced to farm buildings. Investigations by the 15th Medical Laboratory suggest that this disease may have been "Q" fever.

e. Other respiratory diseases. A comparison between 1943, 1944 and 1945 cases is shown in the following table:

	:	1943	0	1944	0 0	1945*		Totals:
Diphtheria (a)		211	:	624	. 0	336	0	1171 :
Meningitis (Meningococcic)	0	167	0	241	0 0	111	0	519:
Scarlet fever		52		102	0	103	:	257 :
Septic Sore throat (a)	:	descen	:	650*	0 0	459		emanceo 8
Rheumatic fever (b)	0	89	0	211	8	96	:	396 :
Mumps		550	. 0	576	0.	288	0	1414:
Measles	*	351	0 0.	179	:	154		684 8
Measles, German	0. 0	189		106	2	124	0	419:
Poliomeyelitis	0	32	0	61	0 -	59	0	152 8
Chicken pox	0	27	0.	60	. 00	11	0	98 8
Small pox	0	9	0	3.	. 0	1	0	13:
Whooping Cough	0	2	00	1	0 .	1	0	ant:
Tuberculosis (c) (all forms)	0	238	00	367	0	225	*	830 :
	茶	8 Mon	ths	Only.				

(a) Diphtheria and septic sore throat. The difficulties involved under field conditions in differentiating diphtheria from septic sore throat no doubt resulted in some error in the reporting of these two diseases. The relatively few cases of post-diphtheritic paralyses which have occurred seem to indicate that few cases of diphtheria were mistaken for septic sore throat.

(b) Rheumatic fever. In a special study of rheumatic fever in MTOUSA, Lt. Colonel Edward F. Bland estimated that "There have been to date (1 November 1944) approximately 1,200 patients in MTOUSA with rheumatic fever and/or rheumatic heart disease". He further states, "In retrospect, if those patients with known heart disease and those who had had rheumatic fever within one year of entry into the service had been excluded, the problem presented to the Army in this theater would have been reduced by 49 percent."

(c) Tuberculosis. These figures are believed to be reasonably accurate. In a special study of tuberculosis conducted

by Captain George T. McKean and Colonel Donald S. King, it was found that 25 percent of 270 tuberculous cases studied had not had chest X-rays prior to induction. In another series of 267 cases, they found that 18 percent gave a history of tuberculosis in their families. It is the understanding of this theater that approximately 10 percent of the Army failed to receive chest X-rays prior to induction and that about 10 percent of the demonstrable lesions were overlooked or those who were X-rayed. If these figures are correct and if it is borne in mind that this theater probably received an abnormally high percent of the early inductees who were not X-rayed it would seem likely that a considerable number of the cases reported existed before arrival in this theater. It is understood that this aspect of the problem is being studied in the Zone of the Interior by examination of induction films in cases returned to the Zone of the Interior.

2. Preventive Measures.

- a. Clothing, bedding and housing. Supply difficulties resulted in shortage of clothing, bedding and overshoes in the winter of 1943-44, but during 1944-45 the troops were adequately clothed. Bedding and housing standards were as good as could be obtained under the conditions which existed. The importance of these matters from a morale as well as a health point of view was fully recognized by the command, and no serious or large scale deficiencies occurred.
- b. Special measures. Isolation of cases and isolation or observation of contacts and other necessary restrictions were promptly applied at lower echelons whenever deemed advisable. Group or mass quarantine measures were not used.
- c. Sulfa prophylaxis. Because of the extremely small (1684*) number of cases of sulfa-susceptible diseases, it was the policy of this headquarters to restrict the use of sulfa drugs as a prophylactic measure, and it was never necessary to use sulfa prophylaxis for respiratory diseases.

*This figure consists of all cases of:

Pneumonia, primary	850	
Pneumonia, secondary	65	
Meningitis, meningococcic	111	
Scarlet fever	103	
Septic sore throat	459	
Rheumatic fever	96	
Total	1,684 (first 8 months	s 45)

3. Military importance.

The costs in terms of man-days lost, reclassification, deaths and evacuations to ZI are shown in appendices 14-16 for three of the most prevalent respiratory conditions.

CHAPTER VI.

Intestinal Diseases (Appendix 2)

1. Epidemiological Experience.

a. General. MTOUSA is an area in which the filth diseases of man have been extremely prevalent for generations. The peace-time sanitary standards are extremely low. The sanitary habits of the people are bad, sanitary facilities are generally inadequate or non-existent and waste disposal methods are in general unsatisfactory. The destruction of war has made these inadequate facilities still less satisfactory, so that the whole problem of preventing intestinal disease is extremely difficult.

Despite these handicaps, the intestinal disease rates have remained at a satisfactory level except for the theater-wide epidemic which occurred in 1943 in North Africa. The only other outbreak of any importance was a small typhoid outbreak which occurred in Fifth Army in October and November 1944. This outbreak was thought to be the result of two factors:

- (1) Poor water discipline. There appears to have developed a temporary general laxness in individual water discipline in some units. Many of the men who became ill admitted they had drunk water from unauthorized sources, and that they had not chlorinated the water.
- (2) Food. It is felt that the attempt to provide hot meals to forward troops was also partially responsible for this outbreak. Since the distance, in time, from kitchens to forward troops was often several hours, it is easily understood how thermos containers could serve as incubators. These conditions were promptly corrected and the rate declined to an acceptable figure.
- b. Common diarrheas and bacterial food poisoning accounted for 6,181 cases or 89 percent of the total intestinal diseases. (First 8 months 1945). When it has been possible to do careful bacteriology most of these outbreaks have been found to be due to bacillary dysentery infections, so that to the relatively small number of bacillary dysenteries reported as such should be added a large percentage of the common diarrheas.
- c. Dysenteries. There were 268 cases of unclassified dysentery, 170 cases of bacillary dysentery and 277 cases of protozoal

dysentery. It is believed that many of the so-called protozoal dysenteries are actually bacillary cases in which protozoal were also found. It is felt that the increased number of cases of protozoal dysentery reported in 1944 and 1945 as compared with 1943 cases is largely a reflection of the greater interest in the problem of etiology in intestinal diseases. This was shown by determining the diagnosing hospital for a sample of 304 cases of the total of 841 reported in 1944. This showed that 245 (80.6 percent) were reported by five hospitals, all of which contain personnel trained at Tulane or other Southern institutions where the interest in amoeba is higher than in the United States as a whole. An analysis of stool specimens found are shown in Appendices 30 A, B, C. The report from the 15th Medical Laboratory does not contain all confirmed cases within this theater but is a fair representation of the distribution of these organisms in Italy. Out of a total of 778 cultures submitted to the Laboratory for confirmation, 539 cultures were found to be shigellae, and 239 coliform and paracolon bacilli,

d. Typhoid and paratyphoid fever. There were a total of 9 cases of typhoid and 17 cases of paratyphoid. With the exception of an outbreak of typhoid fever which occurred in the 349th Infantry Regiment, all cases were probably due to individual infractions of food or water regulations. There were no typhoid or paratyphoid deaths reported in 1945.

2. Preventive Measures.

- a. General. The experiences of 1943 with intestinal diseases were such that all concerned were aware of the importance of good food and water sanitation.
- b. Supply. Advance planning, made it possible in 1944 and 1945 to supply all units with adequate amounts of screen, 5 percent DDT in kerosene, and other necessary supplies. No serious problems developed.
- c. Unit sanitation. Disposal of wastes (human, animal and kitchen) was well handled by United States units. In many instances, units were forced by circumstances to bivouac near civilian or foreign military installations whose sanitary standards often were extremely low. Some of these problems were difficult to handle, but in no instance did these circumstances result in serious outbreaks in the associated United States troops. Allied Military Government (and later Allied Control Commission) were able to develop a semblance of normal sanitary disposal in most civilian areas where United States troops were operating. Problems arising from foreign military units were an most cases effectively handled by direct

liaison between the units concerned.

- d. Mess kit sanitation. In 1944 and 1945 practically all units had improvised hot water heaters or obtained satisfactory standard items. Thus, the problem of supplying adequate amounts of hot boiling water were well met. As an additional factor of safety, many units used germicidal rinse in the last rinse water, especially when conditions made it difficult or impossible to keep the mess kit water boiling at all times.
- e. Fresh fruits and vegetables. The use of fresh fruit and vegetables was approved subject to their being cleansed by the use of a chlorine soak.
- f. Individual sanitary discipline. In general, prior to coming to the theater, it may be said that individuals had not been well indoctrinated in the importance of food and water sanitation. The problem of food and water sanitation is so thoroughly handled in the average United States city or military installation that troops do not fully appreciate the important differences which field sanitation make.
- g. Immunization. No difficulties in the supply of vaccines or in administrative program of immunizations developed. Cultures of E. typhosa isolated were furnished to the Army Medical School.
 - 3. Military importance. See appendices 17-19.



CHAPTER VII

Insect-Borne Diseases

- 1. General. This group of diseases consists almost entirely of malaria and pappataci fever. Some of these diseases were undoubtedly included with the fevers of undetermined origin.
 - 2. Fever of undetermined origin (appendices 3 and 22)
- a. Epidemiological experience. This indefinite category consists mainly of respiratory diseases, sandfly fever, malaria and intestinal diseases. The actual percentages which properly are chargeable to each category from month to month is unknown. It has been assumed that 20 to 40 percent of the year's total F.U.O. ultimately were diagnosed malaria.
- b. Preventive measures. Consisted entirely of those directed against the specific current seasonal diseases.
 - 3. Pappataci fever (appendix 6).
- a. Epidemiological experience. There were a total of 1,840 cases reported in the first 8 months of 1945. This is probably an under-statement as there was a general reluctance on the part of medical officers to make this diagnosis since no positive diagnostic criteria exist. Although the diagnosis was reported in all months except January, February and March, the cases probably occurred only between June and October.
- b. Preventive measures. The use of bed nets and screening was in force principally as a malaria control measure during the sandfly season. As is well known, these barriers are not as efficient against sandflies as they are against mosquitoes. Additional measures consisted of the use of DDT spray on walls and floors.
 - 4. Dengue (appendix 6). Two cases were reported.
- 5. Relapsing fever (appendix 6). Two cases were reported but some of these may be viewed with suspicion. It is known that spirochaetes were never demonstrated in several of these cases and the diagnosis was therefore a clinical one.
 - 6. Typhus fever (appendix 6). One unproven case was reported.
 - a. Typhus control
- (1) The 1943-44 outbreak in Naples proved to be the only severe typhus outbreak which occurred. Although the number of

cases of the disease was not great and the mortality rates were only average (20.9 percent), the conditions present made it extremely likely that a severe outbreak would occur unless control measures altered the epidemiology of the disease. The city was crowded, the civil population was nonimmune and heavily infested with lice and frequent air raids forced large portions of the populace to live in air raid shelters, thus offering excellent opportunity for the transfer of infected lice from typhus cases to nonimmunes.

- (2) The possibility of such conditions arising had long been foreseen by the Surgeon's office North African Theater (NATOUSA). and steps had been taken to provide adequate control. These preparations had been made in North Africa during August to December 1943. but had been handicapped by lack of timely support from the War Department in developing and exploiting the use of insecticide powder methods of louse control. In spite of this background, the effectiveness of insecticide powder delousing had been demonstrated in North Africa by the Rockefeller Typhus Team under theater auspices. Methods of powder delousing were worked out for use in epidemics as well as for prophylactic measures. The United States Typhus Commission was kept informed of these developments and, in addition, had been warned on 19 and 20 November 1943, of the possibility of an epidemic outbreak in Naples. At that time, special DDT supplies had already been requisitioned by United States forces and by Allied Commission as requested and specified by the Surgeon, NATOUSA. Further, the Surgeon was using strong pressure to get the Military Government Section, Allied Forces Headquarters, to take steps to insure organization of civil health agencies in Italy to handle a typhus outbreak and to line up all trained personnel available to United States forces for that purpose. It was suggested that the Rockefeller Typhus Group would be most useful in this connection.
- (3) Although representatives of the United States Typhus Commission passed through Algiers on different occasions during September, October and November of 1943, they made no attempt to survey typhus conditions in the theater and even after they were warned of the possibilities of typhus in Naples on 19 and 20 November, they took no action. It was only after repeated refusals by the War Department to supply DDT and dust guns and the epidemic of typhus had actually begun that the Typhus Commission representatives came to Italy on 6 December 1943. It was not until 20 December 1943 that the Field Director of the United States Typhus Commission arrived in Naples. On 8 December 1943, Rockefeller Typhus Team joined Allied Military Government of Naples and initiated dusting methods of typhus control using Army stock of MYL powder and dust guns in Peninsular Base Section. The program was slow in starting because of inexperience and lack of organization of the civil health service, but by 31 December over 50,000 people had been deloused and most of the case contacts were included in this number. Allowing for the incubation period of typhus fever and applying this epidemiological data to case incidence, it will be seen that by 3 January 1944, the epidemic had definitely been broken. This initial

showing, and subsequent handling of the problem was only possible because the delousing methods, planning, and procurement of supplies and training of personnel had taken place in NATOUSA long in advance. All United States malaria control personnel, United States laboratory personnel as well as other medical personnel had received instructions and training in diagnosis of typhus fever and its control by powder delousing during October and November 1943.

(4) Eighty-three (83) allied officers or equivalent were used in the Naples typhus control program. They were from the following sources:

21 British 62 American

47 US Army, NATOUSA
4 Rockefeller Typhus Team
7 US Typhus Commission
3 US Army, ETOUSA
1 US Navy

- (5) By agreement, the United States Typhus Commission was given direction of the program in Naples from 3 January 1944 to 20 February 1944. The full direction of the civil program was then resumed by Allied Control Commission.
- (6) From 1 November 1943 to 1 June 1944, there were 1914 cases of typhus fever in the civil population of Naples and vicinity. There were 400 deaths, a mortality of 20.9 percent. The mortality rates varied from 2.1 percent in the age group 10-14 to 100 percent for those 70 or above. In the latter group, there were 23 cases. During this period, there were only two cases occurring in United States personnel, 1 doubtful case in United States Army and 1 severe case in United States Navy. This happening was not due to chance; the well run louse control program in all military units has made it a rule that the occurrence of pediculosis, other than that due to crab louse, had been rare in MTOUSA.
- (7) Vaccination against typhus fever has been carefully done in all United States organizations. However, because of louse control methods employed, United States troops have never been exposed, to any extent, to typhus fever in this theater. Therefore, the effectiveness of the vaccine cannot be interpreted.
- (8) The civil typhus vaccination program carried out in the Naples area in January, February and March vaccinated approximately 26,000 persons in Naples by the three-dose technique and another 10,000 by the one-dose method. About

two-thirds of those starting the three-dose immunization completed the series. Outside Naples, some 10,000 one-dose inoculations were administered in cooperation with the Flying Squadron. Among approximately 1,200 vaccinated contacts outside Naples, there were 21 cases of typhus. Most of the onsets in this group were within 12 days of the date of vaccination, but several were 18 or more days after inoculation.

(9) During the months of January and February 1944, planning for DDT reserves for typhus control made it clear that a fairly large percentage of the requirements should be held in the form of 100 percent DDT which could be made locally with delousing powder if maximum requirements were experienced but, if not needed, could then be applied to the malaria program. This prevents unnecessary storage of supplies that have a limited usefulness. Supplies usually take four months from the time of ordering before receipt in the theater; January orders arrive in May. Thus, in the northern hemisphere, typhus control supplies should be ordered in the period August to 1 January, malaria control supplies December to May.

(10) Typhus fever, civil population, Naples and vicinity - 1943 - 1944:

Age Distribution of Cases	and	Deaths	Statistics
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Age Group	Observed Number	D 12 -	Case Fatality
Type Group	of Cases	Deaths	Rate (Percent)
0004	73	10	13.7
5-9	134	5	3.8
10-14	236	5	2.2
15-19	309	29	9.4
20-24	215	17	7.9
25-29	132	15	11.4
30-34	132	29	21.9
35=39	159	41	25.8
40-44	148	51	34.4
45-49	129	52	41.1
50-54	99	47	47.5
55-59	59	32	54.3
60-64	39	24	61.5
65-69	23	. 20	88.0
70-74	13	13	100.0
75-79	4	4	100.0
80=84	5	4 5 1	100.0
85	1	1	100.0
Unknown	4		
TOTAL	1914	400	20.8

4. Malaria

- a. Epidemiological experience. The cases rates and curves for malaria and fever of undetermined origin are shown in Appendix 3 for the theater as a whole. A more detailed description is given in appendix 32.
 - b. Preventive measures. See appendix 32.
 - c. Military importance. See appendices 20, 21, and 22.



CHAPTER VIII

Miscellaneous Conditions

- 1. Infectious Hepatitis (appendix 5).
- a. Epidemiological experience. A total of 37,845 cases were reported in 1943, 1944 and the first 8 months of 1945. The 1944-45 experience differed from 1943-44 in two major respects:
- (1) The peak of the 1944-45 epidemic occurred in December whereas in 1943-44 the peak period was October and November.
- (2) The outbreak of 1944-45 was less sharp than that of 1943 as may be seen in the following table:

	CASES					
	1943	1944	1945	1943	1944	1945
Jan	64	1,798	2,008	4	38	51
Feb	129	1,033	1,276	7	22	32
Mar	69	1,075	1,218	3	17	25
Apr	56	513	761	2	10	. 20
May	25	583	446	1	1.1	12
Jun	43	510	490	1	8	13
Jul	111	570	329	2	11.	12
Aug	218	649	444	.6	12	17
Sep	1,344	1,376		32	21	
Oct	4,804	1,359		108	25	
Nov	4,849	2,150		108	36	
Dec	4.1.23	3.422	BACK A	71	71	
TOTAL	15.835	15.038	6.972	37	22	

No effort will be made in this report to discuss all of the work which has been done in an attempt to uncover the method of transmission of this disease. All pertinent information was forwarded to The Surgeon General's Office as completed and a lengthy report summarizing the theater experience has been submitted.

b. Preventive measures. Although the method of transmission has not been proven, the evidence for gastro-intestinal spread is sufficiently strong that this office has considered it desirable to publicize this possibility and to take steps toward raising the standards of food and water sanitation.

An explosive outbreak of hepatitis in the 1st battalion of the 86th Mountain Infantry Regiment of the 10th Mountain Infantry Division gave good epidemiological evidence that the disease may be water borne. In this outbreak only those individuals who had access to a shallow well located near a privy, contracted the disease.

Important points learned about infectious hepatitis in this theater are as follows:

- (1) The disease has a distinct seasonal trend with a peak in the fall and early winter and a low summer incidence.
- (2) The incubation period appears to be about 3 or 4 weeks.
 - (3) Second attacks are not common.
- (4) The incidence is higher in combat troops perhaps because of frequent replacements, perhaps because of living conditions.
 - (5) The disease may exist without jaundice.
- (6) The mortality varied from 0.76 per 1000 from 1 January 1943 to 31 March 1944 to 3.6 per 1000 the last nine months of 1944.
- (7) Intramuscular injection of 10 cc of gamma globulin seemed to give some protection against the disease.
- (8) Essentials of treatment are: Rest, high protein, high carbohydrate, low fat diet including skim milk and steaks, adequate convalescence.
 - c. Military importance. See appendix 28.
 - 2. Scabies (appendix 6).
- a. Epidemiological experience. There were 3,122 cases reported in the first 8 months of 1945. It is believed that the increase in 1944 and 1945 is partially due to more accurate reporting. Undoubtedly there was some increase. This was due to the much more intimate relations which existed between the troops and the Italian population as compared with the rather limited contacts between troops and the natives of North Africa in 1943. The units of this theater have achieved a high level of personal hygiene by means of improvised bathing and laundry facilities and by organized plans for exchange of clothing for combat units. This has served to keep scables at an insignificant level. The use of benzyl benzoate has proven to be highly successful in treatment and has also helped to minimize the control problem.
 - 3. Mycotic dermatoses (appendix 6)
- a. Epidemiological experience. Four hundred and eighty-seven cases were reported in the first 8 months of 1945.

Obviously this is an understatement of the total amount of tricophytosis. This figure closely approximates the number of cases which have been severe enough to require hospitalization.

- b. Preventive measures. General measures directed toward high standards of personal hygiene as outlined above plus the thorough training in foot care which has been carried out in this theater, have kept this condition at minimum levels.
 - c. Military importance. See appendix 29.
 - 4. Trench foot (appendix 5).
- a. Epidemiological experience. The problem of trench foot in 1944-45 as compared with 1943-44 is shown in the following table:

Cases						
	1943	1944	1945			
Jan	0	1,385	443			
Feb	0	1,595	346			
Max	0	867	133			
Apr	0	12	56			
May	0	0	11			
Jun	0	0	3			
Jul	0	0	0			
Ang	0	0	0			
Sep	0	0				
Oct	0	15				
Nov	63	445				
Dec	1.248	372				
TOTAL	1.211	4.691	992			

Thus, it will be seen that 5,070 cases occurred during six months of the 1943-1944 season and 1,824 cases during the 1944-1945 season. Since the condition was not generally understood and was not made reportable until December 1943, the figures for October and November 1943 are grossly deficient. The condition was almost entirely limited to combat troops.

b. Preventive measures. An extensive training program on foot care and wearing of clothing was instituted late in 1944 in the Fifth Army and in the Replacement and Training Command. Continuous supervision of foot care was maintained within Fifth Army. Adequate supplies of footgear were available in the army in 1944 and 1945 and the provision of fresh dry socks and clothing for men in combat was thoroughly organized. Practically all cases occurring in 1944-45 were due either to situations in which men were "pinned down" for long hours and hence unable to obtain a change of socks or were due to previous vascular damage in army or civilian life.

- beachhead, much was learned about the prevention, control and treatment of trench foot. This information was immediately made available to the War Department and other theaters through Essential Technical Medical Data reports. A study was set up in the Anzio beachhead in the 3d Infantry Division to determine the best type of clothing and equipment needed for the prevention of trench foot. The data so obtained was used as the basis of ordering winter equipment for MTOUSA troops. These orders were submitted in April 1944 and the equipment reached the theater in September. Distribution to troops began in October 1944 and all personnel in exposed positions were adequately supplied early in the season. The innovation of the shoepack caused considerable complaint at first because of failure to make proper fits and to supply sufficient ski socks. These conditions were remedied and the use of this equipment in cold and wet weather can be considered a major success.
- (2) Throughout the year, training programs in care of the feet have been conducted by units and through special schools in rest and replacement areas. Veteran troops were well indoctrinated but considerable trouble was experienced in training replacements from the United States who had not received previous instructions.
- (3) Weather conditions in the Apennines are as severe as encountered in any of the major United States combat theaters. Low rates must be attributed to preventive measures which were aimed not only at equipment and care of feet, but also at wearing of clothes in general.
 - 5. Gas gangrene (appendix 6).
- a. Epidemiological experience. The number of cases in comparison to total battle casualties is shown in the following table:

	1943	1944	1945
Total Gas Gangrene	. 13	109	. 4
Total Battle Casualties	31,045	88,463	11,433
Ratio	1:2388	1:812	1:2858

The increased incidence in 1944 was anticipated because the soil of Italy was known to be more highly contaminated with anaerobes than was that of North Africa where most of the 1943 casualties occurred.

- b. Preventive measures. The routine use of penicillin in all serious wounds has undoubtedly prevented the development of many cases.
- 6. Tetanus (appendix 6). Only three cases were reported, one each in 1943-44-45.

7. Non-battle injuries (appendix 8).

a. Epidemiological experience. The cases, rates and deaths for 1943, 1944 and the first 8 months of 1945 are shown in the following table:

Injuries									
		Ca	ses		R	ates]	Deaths	3
	1943	1944	1945	1943	1944	1945	1943	1944	1945
January	1,789	7,938	4,055	123	166	103	16	60	103
February	2,809	5,752	3,510	149	121	81	22	47	80
March	3,389	7,084	4,260	148	114	89	25	80	92
April	5,232	6,225	3,740	160	117	98	56	59	113
May	4,308	7,574	3,531	151	142	98	56	172	123
June	4,810	9,631	3,307	145	143	85	94	175	90
July	7,902	7,803	1,936	173	146	71	111	138	95
August	7,153	6,724	1,584	161	125	62	92	182	61
September	5,837	9,061		137	137		64	180	
October	6,037	7,241		136	135		49	104	
November	5,895	8,350		132	139		45	144	
December	6.274	5.166		108	107		79	87	
TOTAL	61.435	88.549	25.923	143	132		709	1428	757
Battle	31,045	88,463		72	132				
Casualties									

(1) These figures demonstrate the tremendous loss which occurs from injuries. Examination of the cases, rates and curves (appendices 10-12) for injuries and battle casualties shows that injury rates are not closely related to battle casualty rates. Special studies conducted in this theater have demonstrated the following as the general causes of nonbattle injuries:

Falls	Percent 29.6
Vehicles	23.1
Weapons and Explosives	11.7
Brawls and fights	9.5
Burns	6.6
Falling Objects, Machines and Miscellaneous	19.6
Total	100.0

(2) Detailed study of individual injuries often reveals an element of carelessness or negligence.

b. Preventive measures. The extent of the manpower loss resulting from injuries was brought to the attention of the MTOUSA staff and a safety committee was formed. This committee began to function and drafted a safety policy for the theater which is expressed in a MTOUSA

Circular Letter (appendix 33). The lowered number of cases and deaths and the strikingly low rate in December 1944 and 1945 give evidence of the effectiveness of this program.

c. Military importance. See appendices 11 and 12.

CHAPTER IX.

Special Topics

- 1. Clothing, shelter, bedding, individual equipment and reporting.
- a. General. On the whole, United States Army supplies of these types were satisfactory. In planning, it should be borne in mind that most nontropical foreign areas are not well supplied with fuel. Most houses are not centrally heated. For the most part, troops live in tents and in combat areas, they frequently must sleep on the ground. Therefore, in wet and cold weather, it is difficult to keep warm unless satisfactory equipment or facilities are provided. If they are not provided, improvisation will be made, some of which result in mishaps, such as burns.
- b. Footgear. In a climate such as in Italy, it is essential that combat troops be supplied with warm and water-proof footgear. Provision must be made for frequent changes of heavy warm socks. Training of troops for areas such as this cannot overstress the importance of foot care. Finally, outer clothing (trousers, raincoats and overcoats) should be designed so they do not serve as wicks for funneling water into shoes and shoe pacs.

The use of the shoe pac, heavy socks, and rigid foot discipline kept the problem of trench foot at a minimum in the winter of 1944-45. Some complaints were registered to the effect that shoe pacs were heavy and clumsy and further study to develop a lighter but equally sturdy shoe pac would seem desirable.

- c. Outer clothing. Satisfactory, no changes recommended, except as noted under footgear.
- d. Water repellents. All outer garments should be water repellent and facilities should be provided for local reimpregnation of cleaned and laundered clothing.
- e. Cots and bedding. A collapsible metal and canvas cot similar to British and German models should be developed for use in shelter tents so that it would be possible to sleep off the ground. In general, sleeping bags are to be preferred over blankets as bedding. In forward areas, sleeping bags must be so constructed that the individual can quickly release himself and get free in the event of surprise raids.

- f. Mosquito bars, nets and gloves. Mosquito head nets and gloves have proven impractical and were considered unnecessary after satisfactory insect repellents became available. The standard mosquito bars were considered excellent and no changes are recommended.
- g. Shelter tents. There is a need for better water repellents and a canvas floor for tents.

2. Bathing and Laundry.

- a. General. Bathing and laundry units, while of great value, cannot possibly be provided in sufficient numbers to meet all bath and laundry requirements of troops in the field.
- b. Bath Units. Bath units are of primary value in forward areas where no other facilities are available to troops. It is impossible and wasteful to attempt to provide this service to rear area troops as well. It is therefore necessary for them to provide their own unit facilities, and this requires improvisation. The provision of simple valves, shower heads, water heating units, etc., which could be utilized in a variety of ways would be highly desirable. Simple instructions and simple designs for improvising such facilities would also be useful.
- c. Laundry Units. Laundry units cannot be provided in sufficient numbers to serve all troops. Experience has shown that a great deal of the laundry service of troops in this theater is provided by native women. This has proven to be one of the chief sources of spreading scables to our troops. Therefore, it would be highly desirable to provide small units with some simple practical equipment necessary for doing their own laundry.
 - 3. Records and Statistics. No comments.
- 4. Medical Records. Only two aspects of this subject will be discussed.
 - a. Statistics for month of November 1944.

Because of the transfer of large numbers of troops from this theater to ETO on 20 November 1944 certain difficulties developed with respect to medical statistics.

The facts of the situation are:

- (1) Hospitals under the jurisdiction of this theater cared for all casualties occurring in southern France.
- (2) Patients from southern France continued to be evacuted to Italy until 9 December 1944.
- (3) Units which utilized MTOUSA medical facilities and their strength are shown in the following table:

Week	Seventh	VV	lst	100 & 103		DELTA	
Ending	Army	Corps	ABTE	Inf Divs	CONBASE	BASE	TOTAL
4 Nov	115160	28696*	11714	38461*	23546	30149	247746
11 Nov	130796	28696*	12207	38461*	25690	30588	266438
18 Nov	147247	28696*	12675	38461*	34912	31744	293735
25 Nov	150855	34671	12198*	* 38461*	40162	37835	314182
* G-1 R	eports	** Est	mated				

- (4) Since this office as well as the Surgeon General's Office commonly makes reports on 4 or 5 week periods, it was necessary for this theater to drop the Southern France figures in order to have a reasonable complete picture for the month.
- (5) Inasmuch as many of the communicable diseases were not diagnosed until the evacuated individuals had reached hospitals in Italy (and were therefore reported by those hospitals), it appears that the most nearly accurate method to adopt is the latter, and this precedure was adopted in this theater.

b. Medical machine records.

- (1) General. Because operations in this theater had demonstrated a number of serious defects in the standard reports and records system as applied to an active theater of operations, a careful detailed study of the whole problem was begun in the early part of 1944. Some of the major defects are:
- a. The medical statistical report (WD MD 86ab) does not relate diseases to the organization to which the individual is assigned or attached but to the higher echelon operating the hospital in which the diagnosis is made. This criticism applied to all sections of the report so that the only accurate information available on incidence of various diseases, on noneffective rates, is for the theater as a whole. Such figures obviously are of no value from the preventive medicine standpoint in a theater of this size.

- b. The directions for completing the 86ab form are complicated and often lead to confusion at the lowest levels where the reports originate.
- c. The 86ab report even if properly completed does not provide a great deal of statistical information which is operationally necessary within a theater of operations.
- d. These defects lead to the establishment of numerous intra-theater reports which often are partially duplicating and create unnecessary burdens for the units which submitted the basic reports.
- e. The informational needs of AG, G-1 and other sections of the staff with respect to hospitalized personnel are not properly integrated into the Medical Department reports and record system. After thorough analysis of the problem, it was concluded that the solution was to be found in the application of machine records procedures. It was decided that the problem should be considered from two main aspects, namely that of MTOUSA, and also that of the Medical Department as a whole.
- (2) Solution. With this in mind, a request was made on 8 April 1944 that a "Medical Biometrist of Doctor Lowell Reed's caliber be sent to this theater on high priority for sufficient time to study medical statistics and record system and be prepared to make appropriate recommendations to the War Department for necessary changes."

It was impossible for Doctor Reed to visit the theater, but Major Harold F. Dorn was sent to the theater on 15 May 1944. The problem was reviewed with Major Dorn and visits were made to various installations and headquarters throughout the theater.

These studies demonstrated that the problem was not purely medical. Certain information regarding hospitalized personnel is of great interest to the Adjutant General, G-1, the Replacement and Training Command, G-3, Transportation Corps and others. It was obvious that if each of these staff sections collected the information it needed independently of other sections, the result would be:

- a. Duplication of reports required of hospitals.
- b. Variation in definitions which lead to con-

fusion.

c. Variations in resulting figures on supposedly identical conditions.

d. Duplication of effort at higher echelons as the result of multiple analyses of similar or duplicated reports.

The system designed as the result of these studies was, therefore, intended to be flexible enough and sufficiently wide in scope so it would embrace the needs of all concerned and gradually centralize into one report, most of the statistical and administrative information required of hospitals.

The single report received from hospitals would then be utilized in accordance with individual sections' needs by all staff sections concerned.

Accordingly, although the AG and the Surgeon's Office took the leading role in developing and implementing the system, the needs of G-1, the Replacement and Training Command and others were carefully considered and so far as practical integrated into the system.

(3) Procedure.

a. Basic Report. The basic report required for the operation of the system is an admission and disposition report which was standardized as a preliminary to the start of the system.

b. Development of codes. Since no codes were available which would fit the purposes of this system, it was necessary to develop a series of codes* for:

- 1. Diagnosis.
- 2. Anatomical locations.
- 3. Causative agents.
- 4. Surgical operations.

These codes were then arranged in alphabetical sequence for the use of the medical coders.

c. Training of coders. A short course of instruction was given to the medical coders in which they were made thoroughly familiar with:

^{*} The codes and coding and manual used in the Statistical Division of the Surgeon General's Office formed the basic pattern for these two items.

- 1. The Coders Manual.* A booklet prepared for their guidance and containing various rules governing the selection of the proper codes for various conditions.
 - 2. The use of a medical dictionary.
 - 3. The general concepts of anatomy and

(3) Operations.

pathology.

- a. After the above three steps had been completed and coders dispatched to the mobile machine records units, the system was placed in operation as of 15 September 1944 with the intention of including in the system all units (including those in Southern France). It was considered desirable to do this because:
- (1) The system depends on receiving notification of all primary admissions and all <u>final</u> dispositions occurring within a given closed system (Theater of Operations).
- (2) The Surgeon of the Seventh Army was desirous of having the system instituted for Seventh Army.
- b. However, Machine Records Units attached to units in Southern France failed to transmit punch cards on all admissions to and dispositions from hospitals in Southern France. The result was that none of the few punch cards which were furnished could be used. However, since evacuations from Southern France to Italy continued until 9 December 1944, we were constantly receiving into the MTOUSA hospital system, large numbers of patients on whom no primary admission reports were received. The result was that our system was thrown out of balance to the point where it was impossible to maintain any controls, checks for errors or otherwise perfect the MTOUSA system.
- c. Shortly after evacuations from Southern France ceased, it was possible to survey the MTOUSA hospitalized personnel by means of machine records to derive an accurate census of the hospitalized personnel and thus rebalance the system.
- d. Having reestablished the balance of the system, routine weekly reports were resumed and flowed from the system at weekly intervals until 29 June 1945 when it was necessary to close operations because of redeployment of machine records units.

^{*}The codes and coding manual used in the Statistical Division of The Surgeon General's Office formed the basic pattern for these two items.

- e. The time lag involved in processing A and D reports and rendering tabular reports at theater level was 4 to 6 weeks, but there seems to be sound reason for believing that this could be reduced to about 10 to 14 days.
 - (4) Reports rendered by the system.
 - a. Medical.
 - 1. Routine.
- (a) Admissions by type of case and by diagnosis by higher echelon.
- (b) Dispositions by type of case and by diagnosis by type of disposition.
- (c) Remaining cases by higher echelon by type of case and by diagnosis.
- (d) Venereal disease cases by diagnosis, by race, by higher echelons.

These reports, while similar in nature to those obtained on 86ab reports were potentially much more useful because the number of separate diagnoses was much greater than on the 86ab and included a fairly detailed breakdown of noncommunicable diseases and traumatisms. Furthermore, these reports related the various conditions to the higher echelon in which the man was serving when he became ill and not to the echelon in which the diagnosis was made as is the case with the 86ab report.

2. Special.

- (a) Days of hospitalization required for specific conditions.
 - (b) Evaluation of triage as

carried out.

of various hospitals.

- (c) Study of evacuation practices
- (d) Determination of amount of readmission for such conditions as malaria, jaundice, psychiatry, etc., which occurs.

(e) Study of causative agents causing various types of trauma.

b. Nonmedical. In addition to these medical uses, the system also provided information to the Adjutant General which was obtained by a simple reproduction of parts of the medical card. Some of the uses were as follows:

l. Postal service. With the institution of this system, the Adjutant General was provided with a source of information regarding the location of all hospitalized personnel in the theater.

2. Service records. By furnishing a set of locator cards to Peninsular Base Section, it was possible to greatly expedite the flow of service records in the case of those personnel evacuated from Army to Base.

3. Wounded progress reports. Prior to the inauguration of the system, it was necessary for hospitals to furnish semi-monthly wounded progress reports to the Adjutant General. These were eliminated by the system.

4. Casualty reports. The information furnished by the system served as a useful check on casualty reports received from field units. While the casualty reports could not be dispensed with, it appeared that the resulting check reduced errors and lead to sharper definitions and improved casualty reporting by field units.

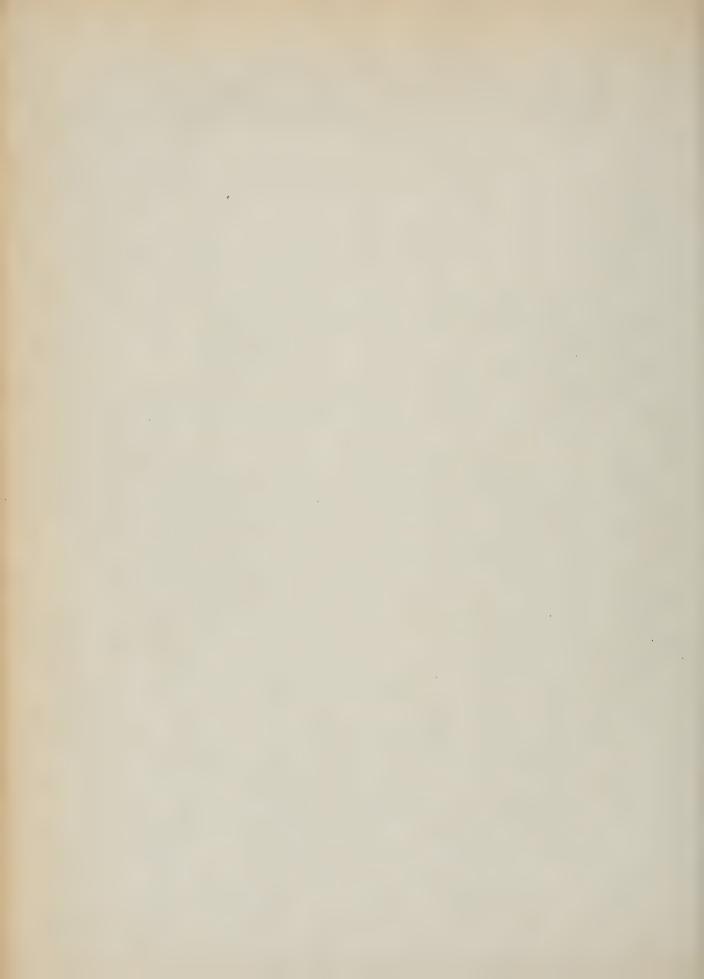
5. Type of disposition. Final dispositions were reported as:

Class A-1 Class A-2 Class B Class C Died in Hospital Dead on Arrival C.R.O. A.W.O.L.

The result was that G-1 and the Replacement and Training Command accumulated accurate data on the percentages disposed to each type of disposition.

(5) Conclusions. Although the system was operated for only 9 months and still required refinement, it seemed clear that the basic approach was sound. The whole problem of clinical

records and reports as applied to an active theater under modern conditions of warfare has been carefully studied by this theater and those observations considered to be of immediate practical value to the Army as a whole have been reported to the Surgeon General's Office.



CHAPTER X

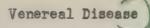
Nutrition

1. B Ration.

- a. Adequacy. The "B" ration, as issued, with fresh meat, butter and vegetables, was entirely adequate from every standpoint. During 1944 and 1945 only isolated complaints regarding rations occurred and these were either unjustified or due to transportation difficulties. There was no evidence of vitamin deficiencies at anytime.
- b. Preparation. Commanding officers learned the importance of good personnel in maintaining good messes. The "B" ration is believed to be as varied as is practical, but it can become monotonous if insufficient care goes into its planning and preparation. This problem was largely solved in this theater, but our experience suggests the need for greater emphasis on this aspect of the problem, as well as in the selection and training of mess personnel.
- c. Distribution. The "B" ration was continuously supplied to all troops except for the forward elements of the combat troops. The Fifth Army attempted to provide these troops with at least one hot meal ("B" ration) daily.
- 2. Emergency rations. "C", "K", and "U" rations were used extensively only by the foremost elements of the combat forces. Here, it was often necessary for food to be provided on an individual or at most, a squad basis. Efforts to bring hot food forward, by means of thermos containers seem to have led to some outbreaks of food-borne dysentery. Under these conditions, troops cannot maintain their mess gear in a clean condition and often they will not even burden themselves by carrying it. Consequently, it would be useful if some simple chemical heating unit could be provided for warming "C" rations and eating utensils provided which could be discarded after use. The modifications in the "C" ration were well received. The "K" and "U" rations were satisfactory.



CHAPTER XI



1. General

The problem of the control of venereal disease has been the most difficult problem encountered in Preventive Medicine in this theater and one which has taxed the resourcefulness and ingenuity of both commanding officers and medical officers. The results obtained have been discouraging in so far as a reduction of the incidence is concerned. The rate for 1945 showed a gradual reduction until VE day in May, after which it took a sharp upswing and the zenith does not yet seem to be in sight. During this year, the majority of the troops have been stationed in Italy where contact with a large white civilian population cannot be avoided. Many individuals stationed in this theater have been overseas from 2 - 3 years, another factor which, it is believed, contributed to the high venereal disease rate. The cessation of hostilities in May found the troops with a great deal of free time and nothing to do. To combat this, rest camp facilities were increased, tours of Switzerland, France and Italy were established by Special Service and the University Training Command conducted a school in Florence. In spite of the redeployment to the United States of a large number of troops each month, the incidence has continued to increase.

2. Epidemiology

a. Rates. The rate in January started out high but showed a gradual decline to 78 per 1000 per annum in April. After the cessation of hostilities, rates have increased each month (see appendix 4a). The rate for white troops varied from a low of 56 per 1000 per annum in April to a high of 85 in January. The rate for colored troops has been about three to four times the rate for white troops.

The syphilis rate is considered to be high as compared to the rate in the United States, having varied from a low of 12 per 1000 per annum in June to a high of 17.8 in February.

The rate for other venereal disease, which is mostly chancroid, showed a marked reduction this year. This may be attributed to the use of the new prophylactic kit containing 15 percent sulfathiazole in a cream base and the improvement of prophylactic facilities with the installation of running hot water in unit as well as metropolitan prophylactic stations. The rate of other venereal disease dropped to 9.7 per 1000 per annum in June, having started out in January with a rate of 21.3.

Gonorrhea as was expected accounted for most of the venereal disease cases. Only 12 cases of granuloma inguinale were reported, all in colored troops. Fifty-six cases of lymphogranuloma inguinale were reported, 37 in colored and 19 in white troops. (Note: These figures are taken from the monthly statistical venereal report which is lower than the figures from the Soab report.)

- b. The rates for the major commands of MTOUSA for white, colored and combined white and colored troops are shown in appendices 4b, 4c and 4d. The rates for Penbase, the Replacement and Training Command, the AAF Service Command and the AAF Engineering Command showed consistently high rates as compared to combat troops or units not located in the large cities of Italy. Troops stationed in and around Naples have always had higher venereal disease rates than troops stationed in other areas. The reasons for service troops, which were usually stationed in cities, having higher rates than combat troops needs no explanation.
- c. The percentages of the various venereal diseases acquired by troops in MTOUSA is shown in appendix 4e. The high incidence of chancroid in white troops is noteworthy. No cases of granuloma inguinale were diagnosed in white troops.

3. Preventive Measures

a. General

The responsibilities for venereal disease control of all concerned are clearly indicated in MTOUSA Circular Letter No. 54, dated April 1945. A letter to all major commands by the theater commander calling their attention to the high venereal disease rates and requesting that immediate action be taken to further a reduction was published on 2 January 1945 (see appendix 4f).

b. Prostitution

- (1) All known brothels in the theater were placed out of bounds by order of the theater commander. Clandestine prostitution flourished in all cities in Italy in which troops were stationed. Individuals had no trouble to make pickups on the streets or in bars or at dances to which native girls were invited, even though the girls were screened and approved before they could enter the dances.
- (2) Physical examination of licensed prostitutes or women suspected of being sources of venereal infections to allied troops by Italian physicians was done in a haphazard and slipshod manner, if at all. Lack of proper drugs prevented the treatment of Italian women who were found to be infected. Hospital facilities in many instances for the isolation of venereally infected individuals was insuf-

ficient. An effort was made in conjunction with the British Medical Section through Allied Commission to improve diagnosis and treatment in Italian hospitals but our efforts never materialized. A meeting was held in Rome in February 1945 with the Italian Health Authorities, Allied Commission and representatives of the United States and British Medical Sections, in which the proposition was made to station an Allied Medical Officer in Italian hospitals in which venereal cases were treated for the purpose of bringing the Italian standards up to Allied standards. The supply of drugs, including penicillin for sulfaresistant gonorrhea, was to have been furnished from army stocks. The proposition was rejected by the Italian health authorities. As a result many infected women still roamed the streets for lack of treatment.

c. Education

- (1) The usual educational program consisting of poster, talks and films have been followed.
- (2) The appointment of a nonmedical commissioned officer to serve as venereal disease control officer for each unit was encouraged. Noncommissioned officers were appointed to assist him so that education could be conducted for small groups of men.
- (3) Each major command was requested to establish schools for the education of the above individuals so that they could return and educate others in their respective units. The schools consisted of about 6 hours of instruction and covered all phases of venereal disease control. It is believed that this concentrated indoctrination assisted in lowering the rates before VE day.
- (4) A survey was conducted throughout the theater to determine what percentage of the individuals have acquired venereal disease since being overseas. This was reported in the Essential Technical Medical Data report. It was found that a relatively small percentage of soldiers is responsible for the major percentage of the venereal diseases in this theater. Only 6.20 percent of the white troops and 18.86 percent of the colored troops stated that they had acquired a venereal disease since being overseas. Efforts were made by units to concentrate the education on individuals who have had venereal disease previously and on the repeaters. The keeping of rosters of venereal cases in each unit was encouraged. Instances were reported in which individuals had two cases of primary syphilis in one year while one individual was reported as having gonorrhea ten times since being overseas.

d. Contact Reports

(1) No contact reports were required by the theater surgeon because if was found that the information submitted

was worthless due to language difficulties and the unfamiliarity of the troops with Italian cities.

(2) In order to determine in which cities in Italy troops acquired venereal infections, each case was questioned during January and February with the following results:

	JANUARY	FEBRUARY
City	Cases Percent	
Naples	1720 39.0	1492 32.6
Rome		1080 23.6
Florence		238 5.2
Leghorn		157 3.4
Foggia	95 2.2	81 1.8
Bari	92 2.1	80 1.8
Lucca	102 2.3	
	52 1.2	
Montecatini		
Miscellaneous TOTAL	<u>987</u> <u>23.0</u> 4410 100.0	$\frac{1163}{4569} \dots \frac{25.5}{100.0}$

It will be noted that over half of the infections were acquired in two cities, namely Rome and Naples. This picture changed each month depending on the tactical situation except in cities such as Naples, Rome, Leghorn, Bari, and others where the situation was more static.

e. Prophylaxis.

(1) Individual

(a) Individual prophylactic items, both mechanical and chemical were available without cost in adequate quantities. The number that could be issued to each individual was not restricted but precautions were taken to prevent wastage and to prevent them from falling into the hands of the black market.

(b) The one tube prophylactic kit containing
15 percent sulfathiazole and 30 percent calomel ointment replaced the
old two-tube kit in January in prophylactic stations in the Naples and
Leghorn areas. In March, theater stocks were sufficient to make the use
of the one-tube kit universal throughout the theater. The theater circular letter on venereal disease prophylaxis was revised (see appendix
4g). The procedure of venereal disease prophylaxis was changed radically.
Injections into the urethra were omitted entirely. Sulfathiazole, 2 grams,
was continued as a routine part of prophylaxis. The new method was very
simple as compared to the older procedure in which injections of 0.75
percent protargol were used. The reaction of the individual was very

favorable to the new type of prophylaxis. No official complaints have been received by this office.

(c) For the number of mechanical and chemical prophylactic items issued by medical supply, MTOUSA, to units and prophylactic stations see appendices 4h and 41. During the months of May and July over 3 million condoms were issued each month which figures about 6 per month per individual for May and about 7 1/2 for July. The number of chemical pro items issued was much smaller. In May about 1 1/2 kits were issued per individual per month and in July about 1 1/4.

(2) Unit prophylactic stations

All units were required to maintain a prophylactic station with running hot water and a bidet in lieu of a straddle stand. Condoms were available in all pro stations without cost to the individual as well as being available in other places throughout the unit area such as orderly rooms, motor pool, post exchanges, and clubs. Much time was spent in advising and inspecting units so that prophylactic facilities would be up to standard. Attendants at pro stations were required to attend schools for instruction in the proper procedure to administer prophylaxis. The standard of unit prophylaxis has been difficult to maintain during redeployment. However, all staging areas and replacement depots have constructed pro stations that meet theater standards.

(3) Metropolitan prophylactic stations

- (a) Prophylactic stations were operated in all cities in Italy in which troops were concentrated. No effort was spared to make these stations as attractive and inviting as possible to the individual. Running hot water was a basic requirement. The European bidet was used in lieu of the straddle stand so that the individual could sit down and be as comfortable as possible while receiving prophylaxis. In many instances, booths were constructed to insure individual privacy. Condoms were always available without cost in all prostations. The number was not limited but usually not more than six were given to an individual at one time.
- (b) The stations were well patronized as evidenced by the number of treatments administered. (See appendix 4j.) The taking of the name, organization and serial number of the individual and the issuance of pro slips was discouraged but the final decision regarding this was left up to the major command which operated the stations. In most stations only a daily tally was kept of the number of pro treatments given. During the 9 month period, Jan Sept 1945, the number of pro treatments given in the larger cities in Italy was as follows (these figures do not include unit pro stations):

	Jan-Sept-1945	Average per month
Naples	383,389	42,592
Rome	243,791	27,088
Leghorn-Florence Area	75,597	8,399
Bari-Foggia Area	45,049	5,005
Towns adjacent to Naples	17,635	1,959

- (c) A mimeographed list of the street addresses of the pro stations was sent out to all major commands who in turn sent it down to the units. Men going on pass were briefed regarding the location of pro stations in cities to which they were going.
- (d) After the break-through into the Po Valley in April, stations were established immediately in the important cities under the jurisdiction of the Surgeon, 5th Army.

(4) Medical prophylactic platoons

- (a) Six medical prophylactic platoons were utilized to operate prophylactic stations in cities. Each platoon consisted of 27 enlisted men commanded by one Medical Administration officer. Because of the large number of pro stations that it has been necessary to operate in Italy, personnel were difficult to obtain before the activation of these platoons in the latter part of 1944. Usually the prostation personnel had been obtained from hospitals and other medical installations that were located in the vicinity. This procedure put a severe strain on the medical units because their T/O did not allow personnel for the operation of prostations. This personnel problem was solved by the activation of the proplatoons which has worked most satisfactorily.
- (b) The six pro platoons were assigned as follows within the theater:
- a. 302nd Pro Platoon was assigned to the 15th Air Force to operate stations in the Bari-Foggia area. Later it was transferred to the Adriatic Base Command and is scheduled for deactivation in October 1945.
- b. 303rd, 304th and 305th Pro Platoons were assigned to Peninsular Base Section. The 303rd operated pro stations in the Leghorn area. The 304th and 305th pro platoons operated stations in the city of Naples and surrounding area.
- c. The 307th and 308th Pro Platoons were assigned to the 5th Army and operated stations in the Florence area. After the break-through into the Po Valley, stations were established

in all important cities in which there were troop concentrations. The 308th was inactivated in August 1945.

d. The pro stations in Rome were operated by Italian civilian personnel under the jurisdiction and supervision of the Rome Area Surgeon. This arrangement has worked out very satisfactory and has saved critical army personnel.

f. Cooperation with Civil Authorities

The assistance rendered by Italian civilian health authorities in the over-all venereal disease control program in Italy has been of limited value. Italian physicians have been handicapped by a limited supply of drugs and a failure to realize the value of the treatment of women in a venereal disease control program. In addition, the standards of medical practice in Italy are inferior to that of the United States. Due to the economic conditions in Italy, physicians were very susceptible to the acceptance of bribes for rendering false reports on the examination of the women suspected to be sources of venereal infection to the Allied troops.

Medical Sections through G-5, requesting the Allied Commission to increase the emphasis on the isolation and treatment of the women who were found to be infected with venereal disease. Since much of the governmental functions in Italy had been returned to the Italians, Allied Commission stated that they had no jurisdicion except in an advisory capacity. The proposal was made to place an Allied medical officer in each hospital in selected cities in Italy, for the purpose of supervising the Italian doctors in the diagnosis and treatment of venereal diseases. Shortages in medical supplies were to be supplemented from army stocks. This proposal, after much time had elapsed, was rejected by the Italian authorities on the basis that many of the physicians in the venereal disease hospitals were professors, who were capable of handling the cases. They requested an increase in the supply of drugs but the theater army medical supply could not furnish these as this was an Allied Commission function.

A 400 bed venereal disease hospital operated in Naples under the supervision of a British medical officer. Italian physicians were used for the examination and treatment of the women. This was made possible because Allied Military Government still retained jurisdiction in Naples. The hospital was filled to capacity most of the time. The majority of the women were picked up by American and British vice squads and were held in the hospital until rendered noninfectious. Similar hospitals operated in Rome, Florence, Leghorn and Milan, but no Allied medical officer supervised the diagnosis and treatment.



4. Diagnosis and Treatment

The diagnosis and treatment of the venereal disease presented no unusual problems.

The treatment of syphilis with penicillin, which was started in August 1944, was continued using the dosage of 40,000 units every 3 hours for 60 injections or a total of 2,400,000 units. In January 1945, latent syphilis was included in the type of syphilis to be treated in addition to primary and secondary syphilis. No figures are available on the cases of syphilis that relapsed after penicillin therapy, but a few such cases occurred and were re-treated using a total of 4,000,000 units of penicillin. All cases of syphilis were hospitalized during treatment.

In the 5th Army, a special venereal disease hospital was set up and operated by a platoon of a medical battalion. Gonorrhea cases were treated in the clearing stations to save transportation to the venereal disease hospital.

Throughout the theater, gonorrhea cases were treated on a carded-for-record only status. Penicillin was used in all cases.

All penile ulcers were hospitalized until the possibility of syphilis was eliminated. A minimum of three negative darkfields was required on all penile ulcers. The percentage of venereal disease cases diagnosed as chancroid varied from 19.4 percent in January to 10.8 percent in August. (See appendix 49.)

In the Air Forces, uncomplicated gonorrhea was treated in the air force dispensaries but all other types of venereal disease were hospitalized.

5. Military Importance of the Venereal Diseases

a. From the standpoint of loss of time from duty, venereal diseases have ceased to be of great importance to the armed forces. With the use of the sulfonamide drugs and penicillin, the time lost has been cut to an almost irreducible minimum. In July and August 1945, only 3.3 days per venereal disease case were lost from duty. In June, only 316 days were lost from duty by venereal disease cases per 1000 strength per year. This means that one individual out of each 1000 would be absent from duty for 316 days during a year's time on account of venereal disease. (See appendix 4k.)

b. It is believed that the venereal diseases should be handled like other communicable diseases and less emphasis placed on the rates since the time lost from duty is small. Adequate prophylactic

materials and facilities should be provided and the individuals educated in the use of these and the dangers of contracting infections. Since the line of duty status has been changed to "yes" and all forms of restriction removed such as loss of time and pay, unit commanders frequently have remarked that persuasion is the only method of attack that they have left to keep the incidence of venereal disease at a low rate in their units. Since the survey in this theater has shown that all of the venereal diseases are contracted by a relatively small percentage of individuals, (6.2 percent of white troops and 18.8 percent of colored troops) and that many of these individuals are repeaters, a plan to handle this small group should be worked out. Some kind of disciplinary action should be taken against the individual who repeatedly contracts venereal disease.

6, Follow-up of Venereal Disease Cases

Because of laxness in the follow-up of venereal cases by some medical officers, a plan was started by which the Surgeon's office MTOUSA would receive a 3 x 5 card on each case of venereal disease in the theater. (See appendix 41.) A follow-up card at the end of the 3 month follow-up period is received on all the venereal diseases except syphilis. A card is received on each case of syphilis at 3, 6, and 9 months. The syphilis register serves as the 12 month follow-up.

In many instances syphilis registers have been held in unit dispensaries many months and in some instances years when they should have been closed and forwarded to the theater surgeon. This follow-up system would enable the surgeon's office to determine when the register was due and in the event it was not received, a tracer would be sent requesting the register to be forwarded.

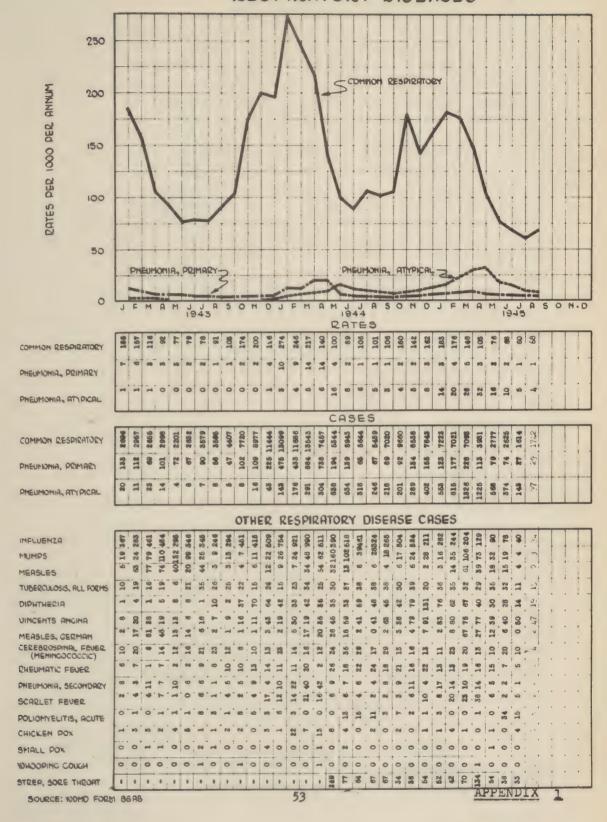
However, this system was put into effect just about the time that redeployment started and because of the return of personnel to the United States and the transfer of personnel from one unit to another, the follow-up system has not worked efficiently.

Tracer letters have been sent out on cases that are delinquent but many have gone unanswered or returned because of the inactivation of units.

On each syphilis register that was forwarded to The Surgeon General, a card was made showing the date it was forwarded. This has been of assistance to the Replacement Depot in the processing of the service records in regards to the date on which the syphilis register was closed. Many of the service records fail to show the date on which the syphilis register was closed. It is believed that such a system should be perfected to insure adequate follow-up of venereal disease cases.

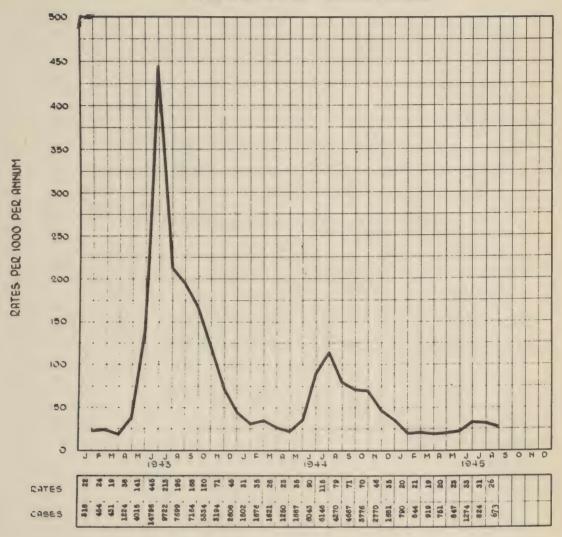


RESPIRATORY DISEASES

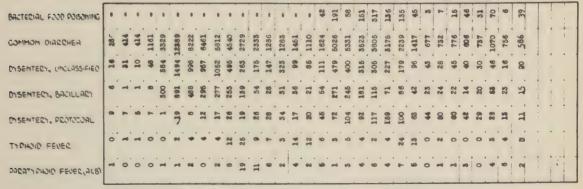




INTESTINAL DISEASES

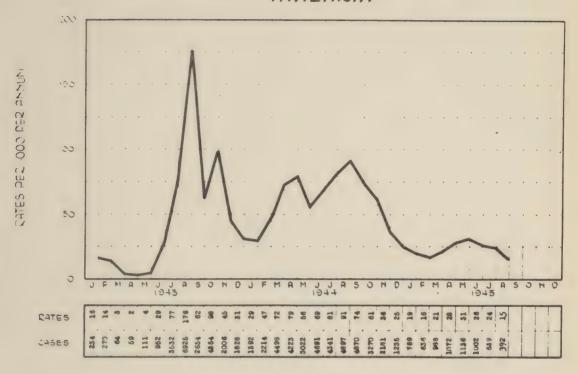


CASES OF SPECIFIC INTESTINAL DISEASES

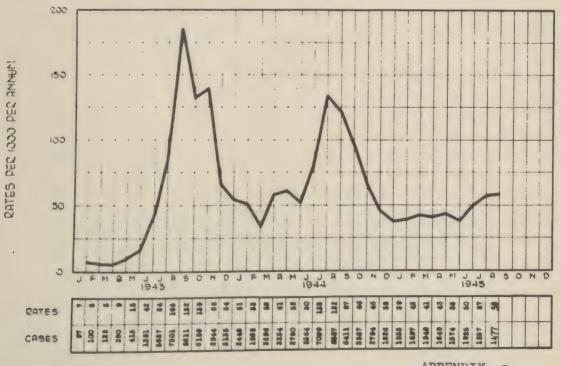




MALARIA



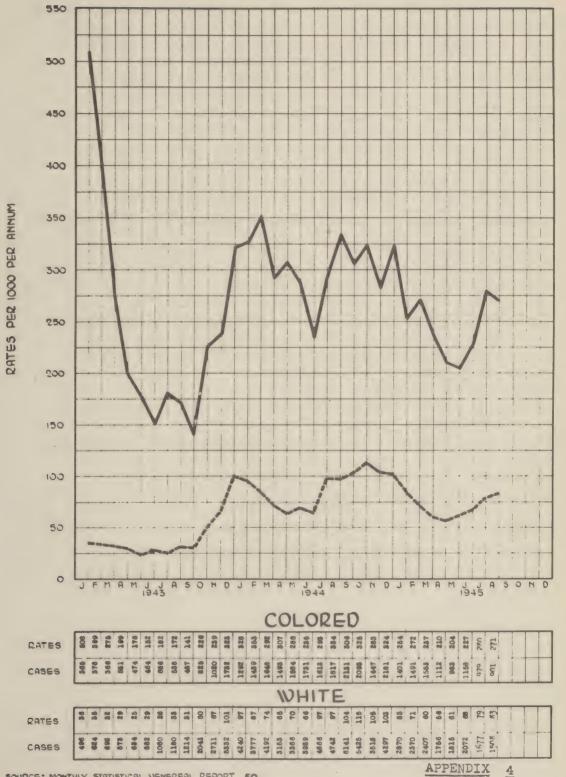
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APPENDIX 3



VENEREAL DISEASE





Venereal Disease Rates per 1000 per Annum, by Color & by Disease
MTOUSA - 1945

		VENERE SEASES		SY	PHILIS		GONG	ORRHEA	•,	OTHER					
1945	WHITE	COLORED	TOTAL	WHITE	COLORED	TOTAL	WHITE	COLORED	TOTAL	WRITE	COLORED	TOTAL			
Jan	85	254	109	8.9	48.3	14.5	64.5	125.8	73.1	11.7	79.4	21.3			
Feb	71	272	100	9.6	67.7	17.8	55.2	137.3	66.8	6.5	66.5	15.1			
Mar	60	237	85	9.1	59.6	16.2	43.9	117.7	54.2	7.0	60.1	14.4			
Apr	56	210	78	7.4	51.0	13.7	42.1	104.2	51.0	6.5	55.0	13.5			
May	61	204	81	7.0	45.4	12.4	49.3	108.9	57.7	4.9	49.6	11.2			
Jun	68	227	90	7.1	41.6	12.0	55.1	150.9	68.7	5.5	34.7	9.7			
Jul	79	280	108	7.9	50.6	14.0	66.0	177.1	81.7	5.3	52.4	12.0			
Aug	83	271	113	7.3	57.5	15.1	71.1	159.7	84.9	4.9	54.2	12.6			
					·										

Source: Monthly statistical Venereal Report.

Appendix: 4 a

Venereal Disease Rates per 1000 per Annum by Major Commands MTOUSA - 1945

Combined White and Colored

1945	TOTAL	5 TH ARMY	PENBASE	NORBASE	MBS	REPLACEMENT	ALLIED FORCE HQ. COMMAND	ADRIATIC BASE COMMAND	12TH AF	15TH AF	AAFEC/MTO	AAFSC/MTO	TOTAL
Jan	109	73	131	190	112	222	50		82	67	112	143	89
Peb	100	69	128	171	81	194	45		90	62	105	129	86
Mar	85	67	121	139		149	43	96	64	46	93	110	62
Apr	78	60	99	98		164	53	75	55	44	70	116	58
May	81	73	95	71		139	34	66	51	52	92	109	63
Jun	90	80	112			115	54	51	74	71	107	127	86
Jul	108	94	144			123	54	94	59	90	162	137	103
Aug	113	83	139			152	67	45		102	151	138	121
				·			1.0						·

Source: Monthly Statistical Venereal Report.

Appendix: 4 b

Venereal Disease Rates per 1000 per Annum by Major Commands MTOUSA - 1945

White

1945	TOTAL	5 TH ARMY	PENBASE	NORBASE	MBS	REPLACEMENT COMMAND	ALLIED FORCE EQ COMMAND	ADRIATIC BASE COMMAND	12TH AF	15TH AF	AAFEC/MTO	AAFSC/MTO	TOTAL
Jan	85	55	87	62	66	186	45		75	59	89	91	71
Feb	71	51	65	24	47	157	42		76	54	58	72	63
Mar	60	51	60	24		107	44	57	53	44	57	65	50
Apr	56	42	51	32		123	50	46	43	41	60	78	47
May	61	53	57	16		118	32	46	49	46	55	55	50
Jun	68	53	65			111	51	23	74	66	71	75	70
Jul	79	65	93			119	49	53	58	81	104	75	78
Aug	83	67	88			131	61	44		86	64	81	84

Source: Monthly Statistical Venereal Report.

Appendix: 4 c

Venereal Disease Rates per 1000 per Annum by Major Commands MTOUSA - 1945

Colored

1945	TOTAL	5TH ARMY	PENBASE	NORBASE	MBS	REPLACEMENT COMMAND	ALLIED FORCE HQ COMMAND	ADRIATIC BASE COMMAND	12 TH AF	15TH AF	AAFEC/MTO	AAFSC/MTO	TOTAL
Jan	252	174	251	346	234	713	265		176	199	174	361	250
Feb	272	164	300	339	148	677	287		336	204	237	336	307
Mar	237	159	280	296		616	0	244	262	73	215	264	187
Apr	210	157	219	182		528	285	197	330	101	111	243	175
May	204	181	198	150		344	200	158	117	147	219	293	213
Jun	227	217	249			183	217	147	148	128	238.	326	237
Jul	280	267	314			156	369	270	283	157	366	383	292
Aug	271	173	297			458	520	61		243	334	386	331

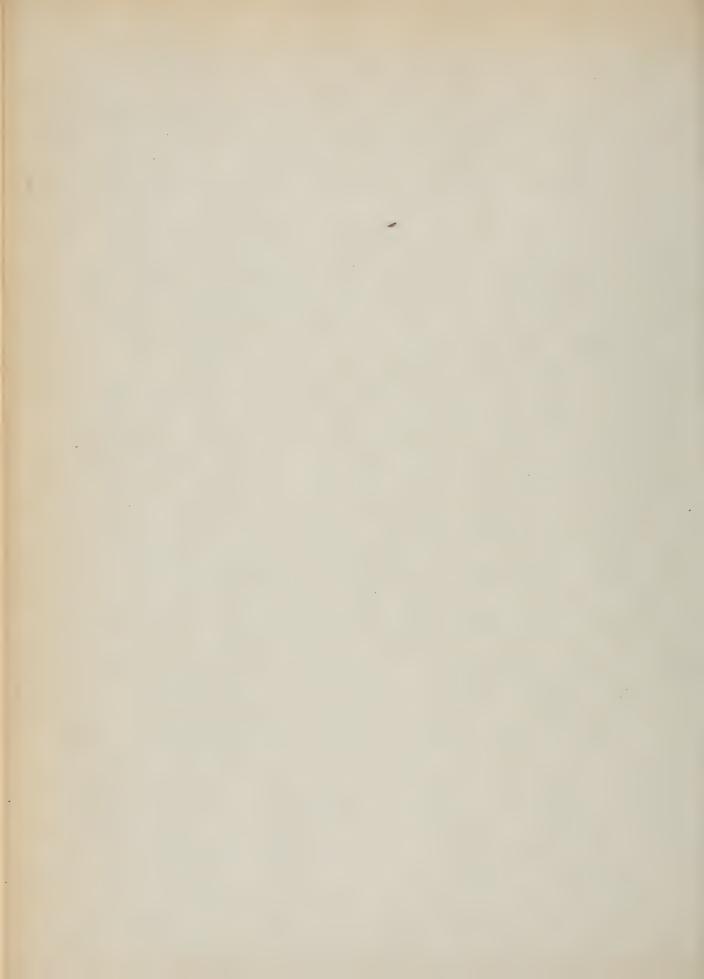
Source: Monthly Statistical Venereal Report.

Appendix: 4 d

Percentages of Venereal Disease Cases That Occurred in MTOUSA, 1945 by Months, by Color & by Disease

	COMBINED	0.02	0.05	0.05	0.17	0.04	0.03	000	0	
GRANULOMA	COLORED	0.07	0.13	0.13	0.4	T°0	0.1	0.4	0	
GRAN	MHILE	0	0	0	0	0	0	0	0	
	COMBINED	0.14	0°16	0.35	0.03	0.8	0.18	0°8	0.4	
LYMPHO RANULOMA VENEREUM	COFOSED	0.4	0.4	0°2	0°1	0.4	0.4	1.0	0.7	
LYMPHO GRANULOMA VENEREUM	AHILE	0°04	0.04	0.3	90°0	0.1	0.05	0.8	0.2	
9	COMBINED	19.4	14.9	16.6	17.1	13.5	10.5	10.8	10.8	
CHANCROID	COLORED	30.9	24.0	24.7	25.7	23.8	14.8	18,2	19,3	
CH	WHITE	13.7	90,1	11.00	11.6	0	E .8	6.6	5.7	
EA	COMBINED	67.2	67.0	63.9	65.2	71.0	76.0	75.7	75.4	
GONORRHEA	COLORED	49.6	50°6	49.6	49.6	53.4	66.4	63.2	58°8	
3	MHILE	75.8	77.4	73.2	75.2	80°5	81.4	83.2	85.3	
70	COMBINED	13,3	17.9	1001	17.5	15.3	13.3	13.0	13.4	
SYPHILIS	COLORED	19,1	24.9	25.1	24.3	22.3	18.3	18°1	21.2	
63	WHITE	10.5	13.5	15.2	13.2	11.5	10.4	10.0	8°8	
	1945	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	

Source: Monthly Statistical Venereal Report.



HEADQUARTERS MEDITERRANEAN THEATER OF OPERATIONS UNITED STATES ARMY APO 512

AG 726.1/002 C/S-0

2 January 1945

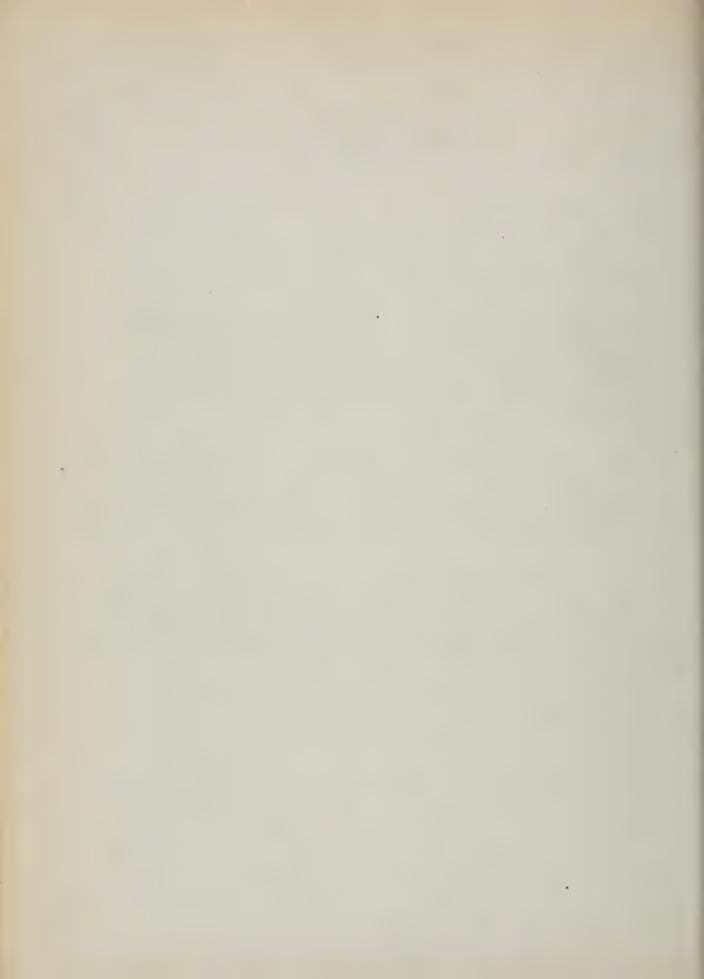
SUBJECT: Venereal Disease Control.

TO : All Concerned.

- l. MTOUSA rates for venereal disease are far too high. This theater has the poorest record for the control of venereal disease of all United States' commands, at home and overseas. The attached rate tables for the month of October indicate a deplorable condition. The venereal rates among both white and colored troops in Peninsular Base Section units, in the Air Forces and in the Replacement Command are particularly unsatisfactory.
- 2. Correction of this condition demands a better troop leadership. Unit commanders are responsible for the health of their troops and must take steps to see that War Department and theater policies on Venereal disease control are enforced. They must, through leadership and appropriate use of their staffs, improve the standards of discipline and increase individual cooperation in venereal disease control measures.
- 3. Venereal rates at least as low as 30 per thousand per annum for white personnel and 60 per thousand per annum for colored personnel can and must be attained. Unit and organizational commanders will take aggressive action to have their commands reduce their present rates to this level. One measure of the efficiency of each commander will be his success or failure in attaining the desired low rate.

By command of Lieutenant General McNARNEY:

C. W. CRISTENBERRY, Colonel, AGD, Acting Adjutant General.



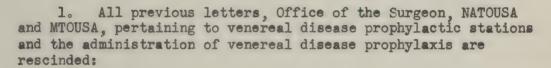
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HEADQUARTERS
MEDITERRANEAN THEATER OF OPERATIONS
UNITED STATES ARMY
Office of the Surgeon
APO 512

23 March 1945

CIRCULAR LETTER NO. 10

SUBJECT: Venereal Disease Prophylaxis



Section I Circular Letter No. 19, dated 26 June 1943.

Circular Letter No. 33, dated 7 June 1944.

Section III Circular Letter No. 42, dated 7 August 1944.

(Designated as Section II by Circular Letter
No. 43, dated 13 August 1944)

- 2. Provisions for prophylactic supplies and stations.
 - a. Prophylactic items for individual issue.
- (1) In accordance with Section I, WD Circular Number 410, dated 19 October 1944, which revises AR 40-210, paragraph 23 b (2) (b) individual venereal disease prophylactic items will be made readily available to all military personnel.
- (2) Individual prophylactic materials will be issued by medical supply officers to units and prophylactic stations without reimbursement in the same manner as any other expendable item of supply. An adequate supply of both mechanical prophylactic (condoms) and individual chemical prophylactic items will be maintained in the unit for distribution without cost to the individual. In no case will prophylactic items be sold. While the number to be issued to each individual is not limited, discretion will be used to prevent wastage.

Appendix 4 g

- b. Unit prophylactic stations and supplies.
- (1) A prophylactic station will be maintained in each unit of company size or smaller in accordance with Section I, WD Circular Number 410 dated 19 October 1944 which revises AR 40-210, paragraph 23 b (2) (a) and in accordance with letter, Headquarters NATOUSA, dated 12 July 1944, file AG 726.1 SURG-0, Subject: "Venereal Disease Control."
- (2) The following articles are considered the minimum requirements for the efficient operation of a unit prophylactic station:

MD Item No.

9118100 Prophylactic, mechanical (condom)
9118000 Prophylactic, chemical, individual
1412000 Soap, soft, 1 lb. jars (GI soap if soft soap
is not available)
1464100 Sulfathiazole, U.S.P., 7.7 gr tablets
7936000 Towel, paper, 150 per package (3 for each patient)
7778000 Cup, paper, collapsible, 250 per carton
7868000 Paper, toilet, roll
Bidet or straddle basin
Facilities to provide running warm water

- c. Metropolitan prophylactic stations and supplies.
- (1) One or more prophylactic stations should be established in all cities or towns which are visited by large numbers of U. S. Army troops. Stations will be conducted under the supervision of the surgeon of the command concerned.
- (2) The following articles are considered the minimum requirements for the efficient operation of a metropolitan prophylactic station:

MD Item No.

9118100 Prophylactic, mechanical (condom)
9118000 Prophylactic, chemical, individual, or
1322110 Prophylactic, ointment, 1 lb. jar
(15% sulfathiazole-30% calomel ointment)
1412000 Soap, soft, 1 lb. jar
7493000 Soap, white, floating, 6 oz.
7489000 Soap, laundry, 1 lb.
7778000 Cup, paper, collapsible, 250 per carton

- 2 -

MD Item No.

1464100 Sulfathiazole, U.S.P., 7.7 gr. tablets
7936000 Towel, paper, 150 per package (3 per patient)
7868000 Paper, toilet, roll
3668000 Depressor, tongue, 100 per carton
Bidets or straddle basins
Clock: Procured locally or hour glass
Closed receptacles in which to keep the
wooden tongue depressors.
Lavatory for patient to wash his hands.
Lyster bag for drinking water
Facilities to provide running warmwater

- 3. Location, installation and operation of prophylactic stations.
 - a. Unit.
- (1) Location. The unit prophylactic station should be located in a room or tent which is used solely for the purpose of administering venereal disease prophylaxis and located so that it will be easily accessible to the entire personnel with a minimum of effort. It may be located next to the showers to avoid duplication of water heating facilities. Stations should not be established in a latrine or toilet.
- (2) Installations. Ample floor space should be provided to prevent over-crowding. Usually one bidet or straddle stand with running warm water is sufficient for one company or smaller unit. The bidet should be raised to an overall height approximately 18-20 inches for the comfort and convenience of the patient. Facilities necessary for ample running warm water can be provided or improvised with reasonable effort. Movable screens may be installed for privacy.
 - b. Metropolitan.
- (1) Location. Care will be exercised in the selection of sites for stations in cities so that they will be near place of exposure and easily accessible to all troops. Stations should be located on the ground floor. Existing civilian buildings should be used and remodeled to make a suitable station. When no existing buildings are available, a prefab or one constructed of dunnage should be considered.
- (2) Installation. Stations should be of adequate size, approximately 12 x 15 feet for small stations. Where it is necessary to provide for more than one prophylaxis being given simultaneously,

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SURG MTOUSA Cir Ltr #10 (cont'd)

a larger space should be obtained. Rooms should be painted white and made as clean and attractive as possible. The floor should be concrete or tile to facilitate easy cleaning. Bidets with running warm water will be installed. Sufficient bidets should be installed to meet demands. The bidets should be raised to an overall height of approximately 18-20 inches to facilitate easy washing and comfort of the patient; should face the medication shelf which should be out of reach of the patient: should be placed about 5 feet from the wall and should be spaced not less than 4 feet from center to center of each bidet. The pipes to each bidet should be buried in the concrete. Hot and cold water should be piped to each bidet and the pipes connected with a T so that the temperature of the water can be regulated by the patient. The pipes should extend above the bidet 8-10 inches with the delivery pipe extending several inches over the bidet. An ample quantity of running warm water should be made available Fartitions or screens should be installed for privacy and should be movable to facilitate easy cleaning of the station. A toilet or lavatory should be provided for the attendants. Stoves should be installed for heating in cold weather. Adequate lighting facilities in the stations should be provided.

c. Posting of Stations.

(1) Unless prohibited by blackout regulations, a green light should be kept burning during darkness on the outside of the station so that it can be seen from a considerable distance. A sign "U. S. Army Prophylactic Station" should be placed on the outside of the station so that it can be read easily from a considerable distance. Directional signs should be placed at strategic places in camps and cities to point out the location of the station.

d. Operation.

(1) Stations will be kept open during the entire 24 hour period and maintained in a clean and orderly condition. Condoms will be available for issue without cost to personnel of the U. S. Army, U. S. Navy and U. S. Merchant Marine.

e. Inspection of Stations.

- (1) The responsible medical officer will inspect the station at frequent intervals to determine that the station is operated efficiently, that supplies are adequate, that prophylactic treatment is administered properly and that the attendants are well trained.
 - 4. Training of personnel to administer venereal disease prophylaxis.

a. Individual.

- (1) The unit medical officer is responsible for the instruction of all troops in the necessity for the proper use of condoms and individual chemical prophylactic kits during and following exposure to prevent venereal infections. The value of proper cleansing with soap and water will be explained carefully. Because venereal disease exposed individuals, especially when intoxicated, will not always administer an efficient prophylaxis to themselves, the necessity for reporting to a prophylactic station for supervised prophylaxis immediately after exposure even though condoms and the prophylactic kit have been used, should be emphasized
 - b. Unit and metropolitan station attendants.
- (1) Prophylactic station attendants should be of good character, conscientious, trustworthy and thoroughly trained in the proper technique of supervised prophylaxis.
- (2) Units not having attached or assigned medical enlisted personnel to serve as attendants in unit prophylactic stations should designate two or more enlisted men to attend schools under the direction of the surgeons of each base section, army or air force. At these schools, they should receive sufficient instruction to qualify them to properly administer and intelligently instruct individuals in the proper technique of venereal disease prophylaxis. The course of instruction should cover the following subjects:
- (a) The meaning and method of obtaining surgical cleanliness.
- (b) The simple facts about the pathogenic microorganiams with special reference to those causing venereal disease.
 This instruction will include laboratory demonstrations of cocci,
 bacilli, and spirochaetes whenever practicable.
- (c) Simple descriptions of the anatomy and physiology of the male and female organs.
- (d) Descriptions of the ordinary symptoms and course of gonorrhea, syphilis and chancroid.
 - (e) The mechanism of venereal disease prophylaxis.
- l. Mechanical prophylaxis (condom). The proper and correct use of the condom will result in maximum protection against all venereal infections of the genitals. Instruction in the

use of the condom should cover the scientific explanation by which venereal infections are prevented and the proper technique for the application and removal of the condom.

2. Individual chemical prophylaxis. The new type of chemical prophylactic kit issued by the Medical Department will be used in addition to the condom in the administration of venereal disease prophylaxis in this theater. The component parts of the chemical prophylactic kit and the action of each component part in the prevention of venereal infections should be thoroughly understood. The prophylactic kit for individual use will be the same as that used in unit and metropolitan prophylactic stations. Therefore, it will be necessary to explain to the individuals the reasons why it is necessary to report to a prophylactic station for prophylaxis as soon as possible after exposure. At the prophylactic station, adequate supervision is provided; hot water, soap and sulfathiazole tablets are available. Individuals may fail to follow the proper technique thoroughly in a self administered prophylaxis, especially if they are under the influence of alcohol.

2. Station Prophylaxis. The following directions for the administration of venereal disease prophylaxis are recommended to be used in this theater and should be posted in both unit and metropolitan prophylactic stations:

a. Patient will wash hands.

b. Patient will remove trousers and drawers and roll up shirt to the waist.

c. The attendant will examine the patient, without touching him, for evidence of venereal disease. No prophylaxis will be given if evidence of venereal disease is present. He will be sent to the appropriate medical installation for treatment.

d. If no venereal disease is present, patient will urinate if possible. This act flushes out the urethra and washes away many micro-organisms.

e. Seated on the bidet or the straddle basin, the patient will pull back the foreskin (if present) and wash head of penis thoroughly with warm water and liquid, soft soap or soap rag. It is very important to pay special attention to the thorough cleaning of the under surface of the penis. The thorough washing will include the lower part of the abdomen, the scrotum (or bag) and the inner surface of the thighs. This procedure should take about five minutes.

f. Rinse off all the soap using plenty of water and dry with paper towel.

g. Each patient will use one individual prophylactic kit or an equal amount of the prophylactic ointment.

h. Have the patient pull back the foreskin (if present) and rub the prophylactic ointment thoroughly over the penis, scrotum, pubic hairs and inner side of the thighs. Be especially careful to rub the ointment on the underside of the head of the penis around the "G String," and in the furrow behind the head of the penis. The rubbing of the ointment should continue for not less than three minutes. Injection into the urethra should be omitted.

<u>i</u>. The penis is wrapped in toilet paper to prevent soiling of the clothes. The paper should be left in place for several hours or overnight.

j. Have patient wash hands and dress.

k. The attendant will give to all patients except flying personnel of the Air Corps, and those who have had a previous station prophylaxis with sulfonamide administered within 8 hours, four (4) tablets or 2 grams of sulfathiazole or sulfadiazine and at least a canteen cupful of water to drink. Attendants will be especially careful to see that the full amount of water is consumed. This is important.

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/s/ E. Standlee

SURG MTOUSA Cir Ltr #10 (cont'd)

- (f) The importance of the prevention of venereal disease will be impressed on the attendants and everything possible will be done to arouse their interest, pride and cooperative spirit in their work.
- 6. Records. A daily count will be kept showing the number of prophylactic treatments given at each station. Recording of names will not ordinarily be done except when special evaluations of prophylactic methods are being made.

For the SURGEON:

E. STANDLEE, Colonel, M. C. Deputy Surgeon.

DISTRIBUTION:

Surgeon, PENBASE	esi	300
Surgeon, NORBS	600	20
Hq. A/G of S	Sile	10
Surgeon, Adriatic Base Command	-	100
Surgeon, Fifth Army		600
Surgeon, AAFSC/MTO	gea	700
Surgeon, Replacement Command	6000	50
Surgeon, Rome Area Command	-	. 25
Surgeon, Hq. Command, AF	con	30
Surgeon, MTOUSA	***	300

HEADQUARTERS MEDITERRANEAN THEATER OF OPERATIONS RESTRICTED

UNITED STATES ARMY Office of the Surgeon APO 512

16 July 1945

CIRCULAR LETTER NO. 23

SPECTACLE PRESCRIPTIONS RESCISSION OF PAR. 4b(2)(e)3k. CIRCULAR LETTER NO. 10.

I - SPECTACLE PRESCRIPTIONS

Considerable delay is being encountered in filling of spectacle prescriptions because of failure of the requisitioning units to indicate correctly the plus (/) and minus (-) signs on optical prescriptions. These signs are an essential part of an optical prescription and must be indicated before the prescription can be filled. Personnel responsible for transcribing optical prescriptions to or from service records will take necessary action to insure complete and accurate transcription of all pertinent data.

II - RESCISSION OF PAR. 4b(2)(e)3k, CIRCULAR LETTER NO. 10

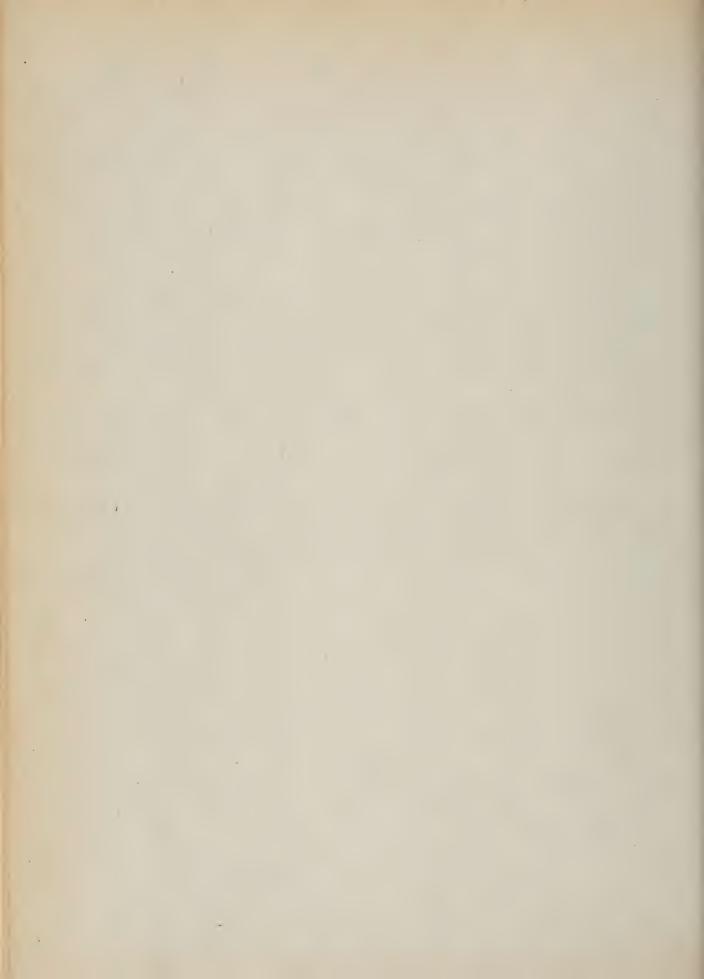
par. 4b(2)(e)3k, Circular Letter No. 10, dated 23 March 1945, is rescinded and the following substituted therefor:

"k. The attendant will give to all patients except those who have had a previous station prophylaxis with sulfonamide administered within eight (8) hours, four (4) tablets or two (2) grams of sulfathiazole or sulfadiazine and at least a canteen cupful of water to drink. Attendants will be especially careful to see that the full amount of water is consumed. important."

> /s/E. Standlee E. STANDLEE. Colonel, M.C., Acting Surgeon.

DISTRIBUTION:

Surgeon, PENBASE - 350 Surgeon, Adriatic Base Command - 100 Surgeon, Fifth Army - 500 Surgeon, AAFSC/MTO - 400 Surgeon, Repl & Tng Comd MTOUSA - 50 Surgeon, Rome Area Command 25 Surgeon, Hq. Command, AF - 30 - 100 Surgeon, MTOUSA



Number of Individual Chemical Prophylactic Kits (9118000) Issued to Units & Pro Stations by Medical Supply, MTOUSA

1945	Gross	Number
10 Dec - 10 Jan	3,500	504,000
10 Jan - 10 Feb	2,817	405,648
10 Feb - 10 Mar	3,026	435,744
10 Mar - 10 Apr	4,327	623,088
10 Apr - 10 May	4,727	680,688
10 May - 10 Jun	5,091	733,104
10 Jun - 25 Jun	1,237	178,128
25 Jun - 25 Jul	3,530	508,320
25 Jul - 25 Aug	3,617	520,848
25 Aug - 25 Sep	542	78,048

Number of Mechanical Prophylactic Items (Condoms) (9118100)
Issued to Units & Pro Stations by Medical Supply, MTOUSA:

1945	Gross	Number
10 Dec - 10 Ja	5,500	792,000
10 Jan - 10 Fe	eb 12,772	1,839,168
10 Feb - 10 Ms	12,238	1,762,272
10 Mar - 10 Ag	or 13,800	1,987,200
10 Apr - 10 Ma	14,170	2,040,480
10 May - 10 Ju	22,165	3,191,760
10 Jun - 25 Ju	in 6,945	1,000,080
25 Jun - 25 Ju	21,187	3,050,928
25 Jul - 25 Au	ng 16,131	2,322,864
25 Aug - 25 Se	12,703	1,829,232

Number of Venereal Disease Prophylactic Treatments Given at Certain Metropolitan Prophylactic Stations in Italy for 1945, MTOUSA (Unit Pro Stations not Included)

	City of Rome	Bari-Foggia Area	City of Naples	Towns Adjacent to Naples	Leghorn- Florence Area
Jan	27,468	2,993	28,388	2,066	1,882
Feb	31,187	2,055	36,191	917	3,038
Mar	36,898	8,493	46,319	98 3	3,319
Apr	28,170	7,191	37,428	1,157	2,581
May	26,353	7,331	53,505	1,470	8,749 *
June	30,936	5,791	46,278	2,326	15,652
July	20,755	4,659	58,508	3,838	19,453
Aug	24,749	4,129	41,131	3,016	13,100
Sept	17,275	2,404	35,641	1,862	7,833
TOTAL	243,791	45,049	383,389	17,635	75,597

^{*} Stations taken over in cities previously operated by Fifth Army

Appendix: 4 j

Average Number of Days Lost from Duty Per Venereal Disease Case

MTOUSA - 1945

Number of Days Lost From Duty by Venereal Disease Cases Per 1,000 Strength Per Year MTOUSA - 1945

	Days		Days
Jan	4.2	Jan	458
Feb	4.4	Feb	417
Mar	4.9	Mar	419
Apr	4.5	Apr	354
May	4.0	May	325
June	3.5	June	316
July	3.3	July	358
Aug	3.3	Aug	366

Source: Monthly Statistical Venereal Report

Appendix: 4 k

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HEADQUARTERS MEDITERRANEAN THEATER OF OPERATIONS UNITED STATES ARMY Office of the Surgeon APO 512

8 May 1945

CIRCULAR LETTER NO. 15

PRIORITY	FOR	DET	ERN	IIN	IN	G (AU	SE	0	FI	EA	TH		IN	NO)N=	BA	TT	LE	D	EA	TE	S	0			I
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FOLLOW-UH																											

I - PRIORITY FOR DETERMINING CAUSE OF DEATH IN NON-BATTLE DEATHS

All non-battle deaths whose initial report of death gives cause of death unknown will be given first priority in the completion of autopsy determination of cause of death. When autopsy findings are complete, the AG Casualty Branch of the command concerned will be promptly notified of the finding.

II - DENTAL RECORDS

- l. Daily work sheets. In the future, in this theater, each dental office performing dental operations, will prepare and keep a daily work sheet. This work sheet will show the name of the patient, the hour the patient was seen, the diagnosis, the operative procedure or procedures performed, the classification at the completion of each sitting and, if not placed in class IV, a notation showing whether or not a reappointment was given. These work sheets will be retained in chronological order for a period of three months after which time they may be destroyed.
- 2. Register of Dental Patients, AGO Form 8-116 (formerly WD MD Form 79). Attention is invited to par. 3, AR 40-1010. Examinations of dental services reveal that the provisions of the above quoted regulation are not being observed in numerous instances. A Register of Dental Patients should be prepared for every patient admitted to a dental clinic. If prepared in longhand they should be legibly written and all required entries made. All register cards should be retained in the organization pending instructions regarding their final disposition.

III FOLLOW-UP OF VENEREAL DISEASE CASES

l. In order to achieve higher standards in the follow-up of venereal disease cases, the procedure outlined below will be adopted:

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Appendix: 41

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be completed in da case of veneres ulcer, cause under this purpose).	ne upper portion of applicate by the mal disease, (urethermined will be these cards will be applicated to the cards will be ap	edical office ritis, cause considered to e forwarded	er who diag undetermin o be venere as follows:	moses and the desired and penilonal diseases	reats le for
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	Organization		Date	of Report	
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	Organization of				
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	Organization		Date of	f Report	
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	Date	Result			
	Remarks				
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APO Organization of Medical Officer Signing

2. Number of reports required:

- a. <u>Initial reports</u> as outlined in par. la above will be required on all cases diagnosed subsequent to receipt of this notice. Medical Officers will also survey the organizations to which they are assigned and complete similar forms on all cases now being followed by them and send one copy to the Surgeon, MTOUSA. The date of report on these will be the date on which diagnosis was made.
- b. Follow-up reports as outlined in par. Ib above will be made to Surgeon, MTOUSA, as follows:
- (1) Syphilis. Three follow-up reports are required, 3, 6 and 9 months after diagnosis. (Since the 12 month follow-up will be contained in the Syphilis Register no special report of this is required, unless it is decided that further treatment or observation is to be given).
- (2) Gonorrhea, Chancroid, Lymphopathia Venereum, Granuloma Inguinale, Urethritis, cause undetermined, and Penile Ulcer, cause undetermined. Only the <u>final</u> follow-up report, made three months after diagnosis will be forwarded to the Surgeon, MTOUSA. (This is not to be interpreted as changing the follow-up procedures as outlined in Surgeon's Circular Letter No. 4, "Management of Venereal Diseases," dated 25 January 1945).
- 3. Transfer of Individuals being followed up for Venereal Disease. In the event of transfer of an individual being followed up for a venereal disease, the follow-up card of the unit will be forwarded to his new unit.
- 4. Death, Capture, Transfer to Z.I., Transfer to Another Theater, or Otherwise Missing Individuals. When an individual who is being followed is lost in one of the above ways, a final follow-up report will be rendered to Surgeon, MTOUSA, stating the facts under remarks section of card shown in par. 1b above.

For the SURGEON:

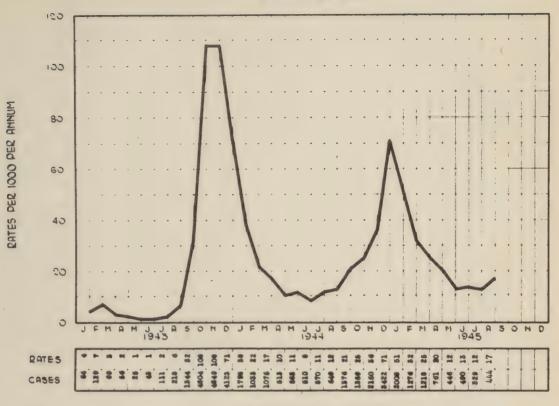
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Surgeon, Adriatic Base Com	mand -	100
Surgeon, Fifth Army	600	600
Surgeon, AAFSC/MTO		600
Surgeon, Repl & Tng Comd, M	TOUSA -	50
Surgeon, Rome Area Command	.00	25
Surgeon, Hq. Command, AF	, en	30
Surgeon, NORBS	600	20
Hq. A/G of S	see.	10
Surgeon, MTOUSA		300

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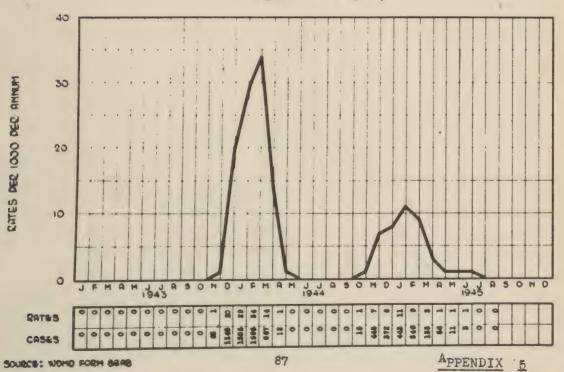
/s/E.Standlee E. STANDLEE, Colonel, M.C., Deputy Surgeon.



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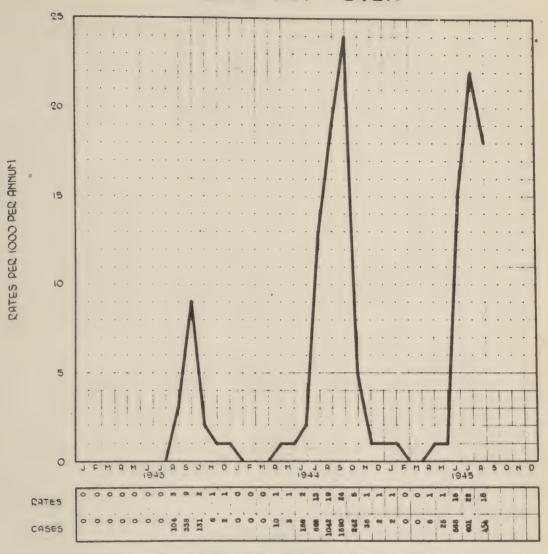


TRENCH FOOT





SAND FLY FEVER

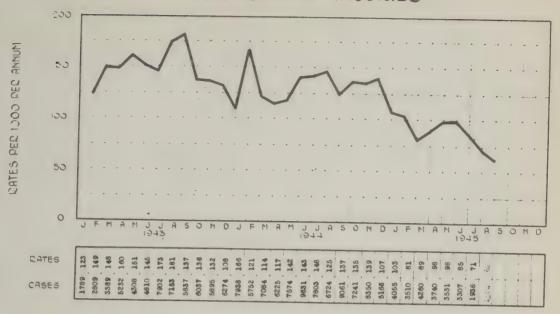


MISCELLANEOUS DISEASES

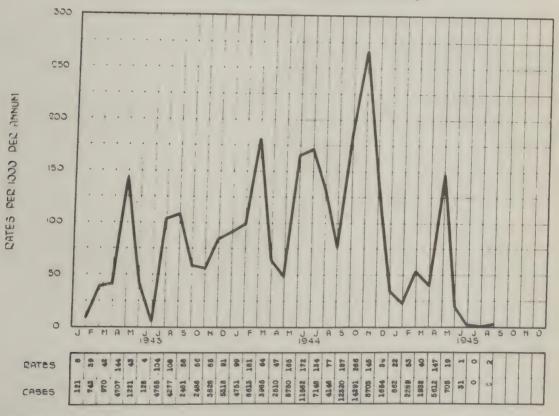
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NON-BATTLE INJURIES



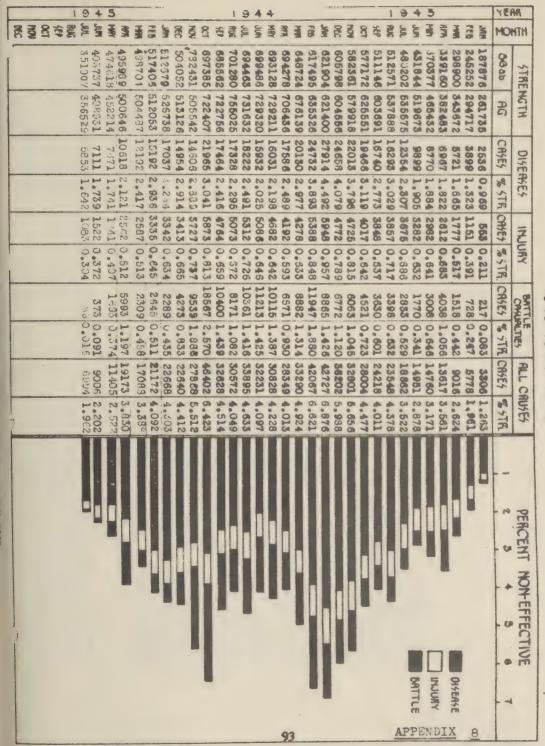
BATTLE CASUALTIES



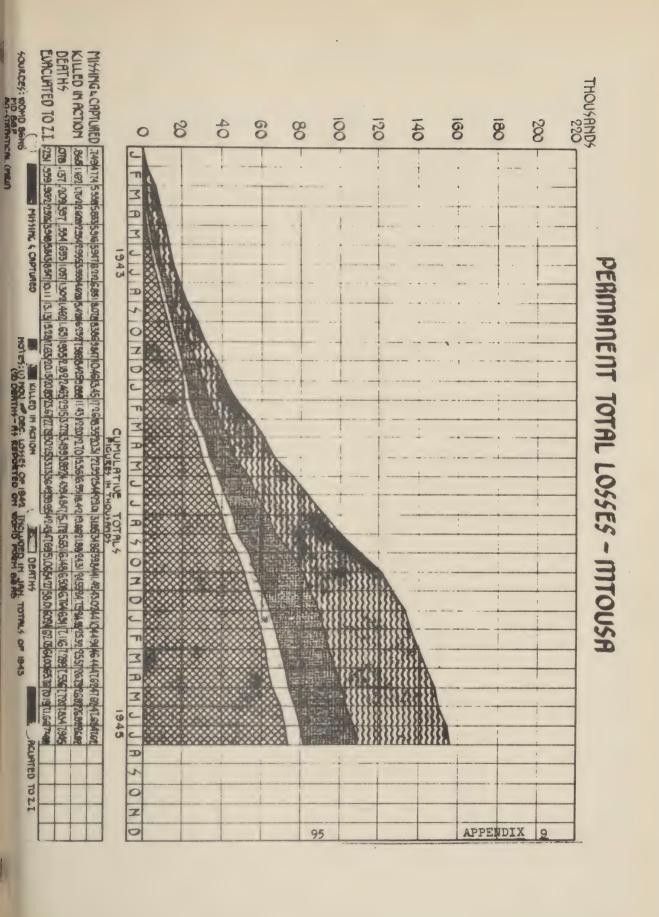


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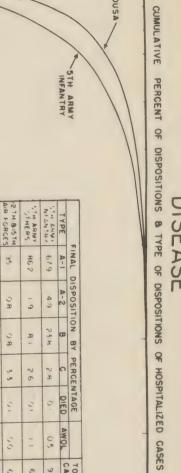
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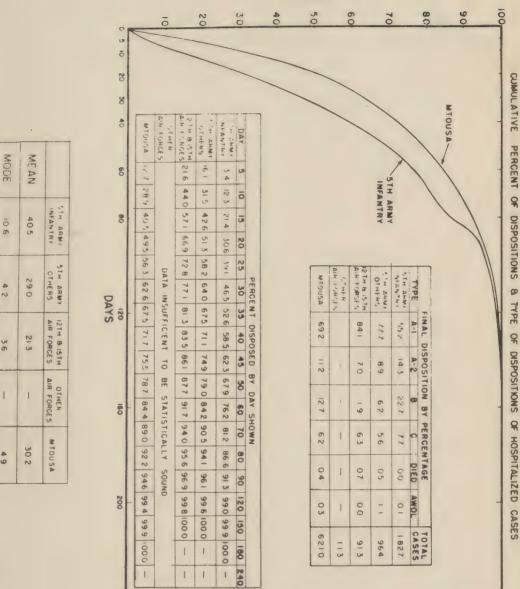
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BATTLE INJURY

CUMULATIVE PERCENT OF DISPOSITIONS & TYPE OF DISPOSITIONS OF HOSPITALIZED CASES

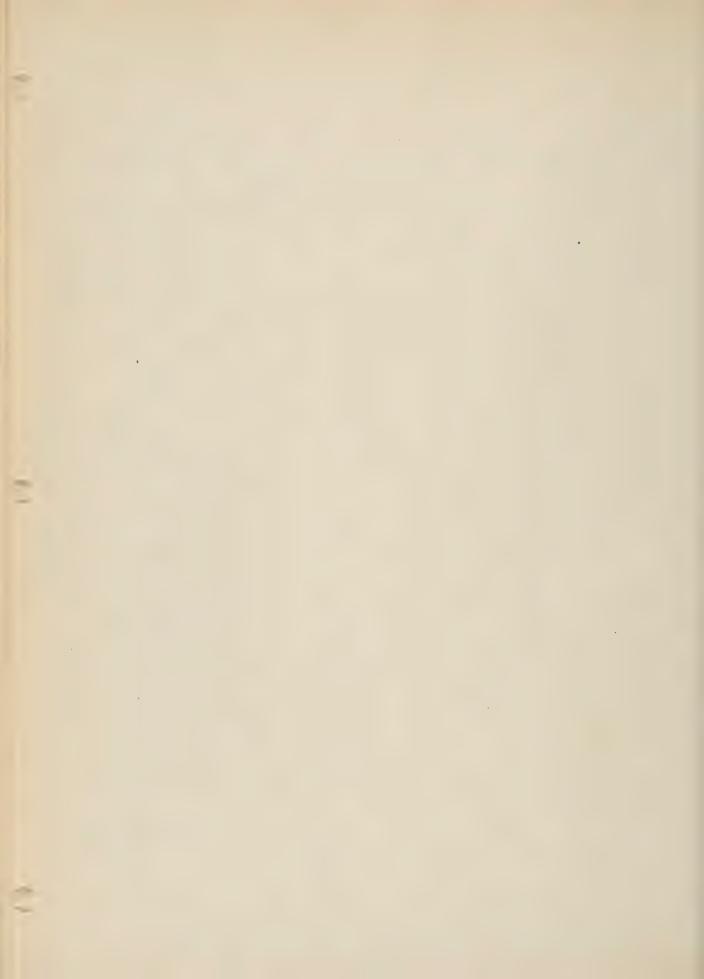
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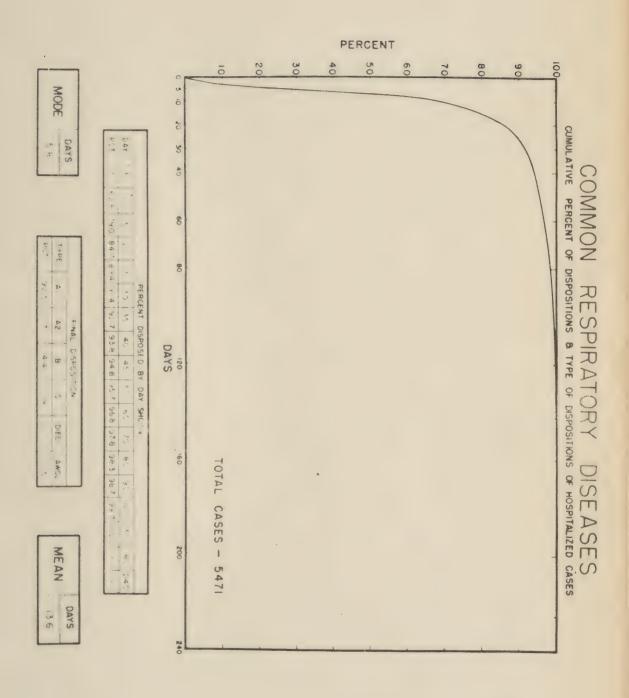


BATTLE WOUND

CUMULATIVE PERCENT OF DISPOSITIONS & TYPE OF DISPOSITIONS OF HOSPITALIZED CASES

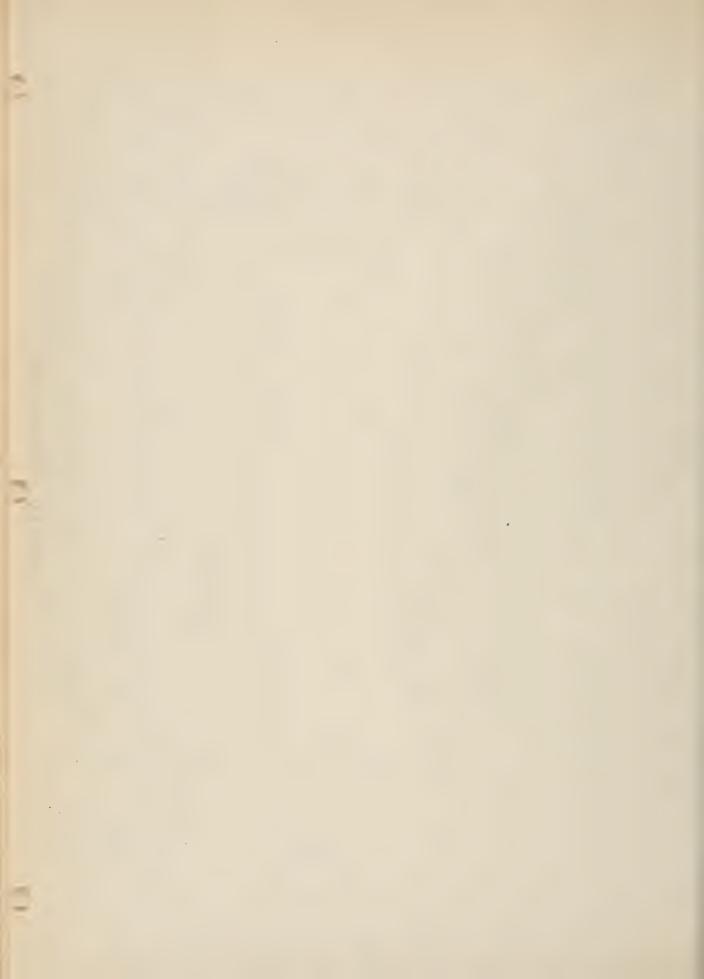
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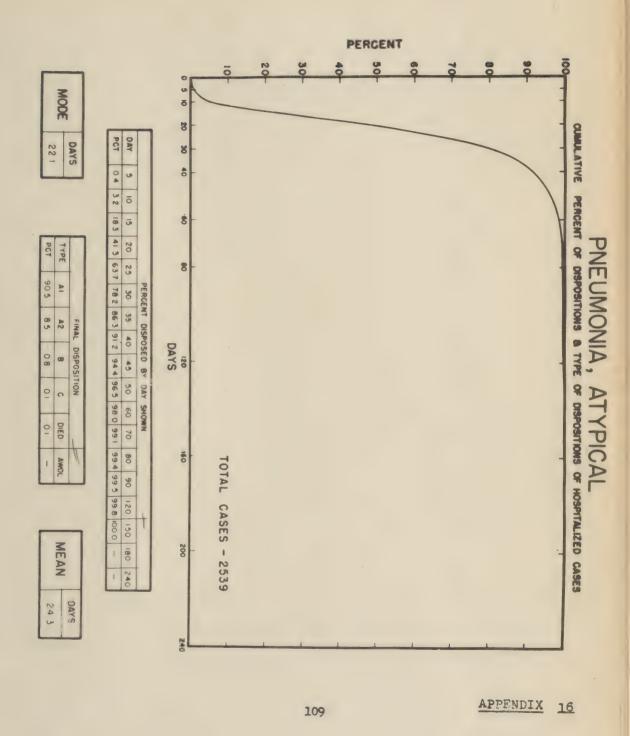


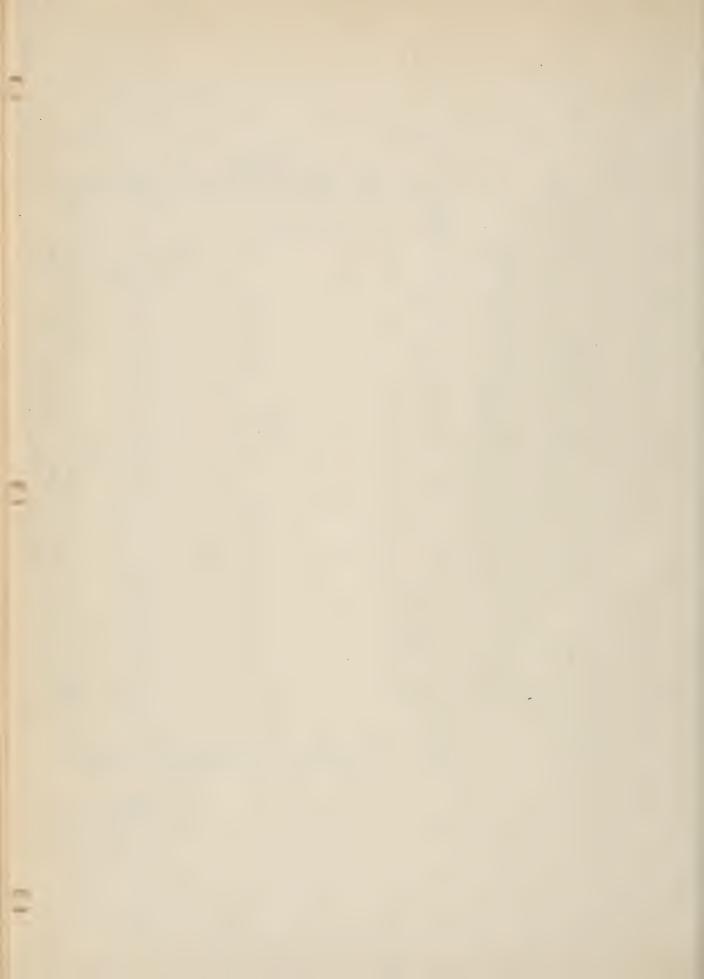


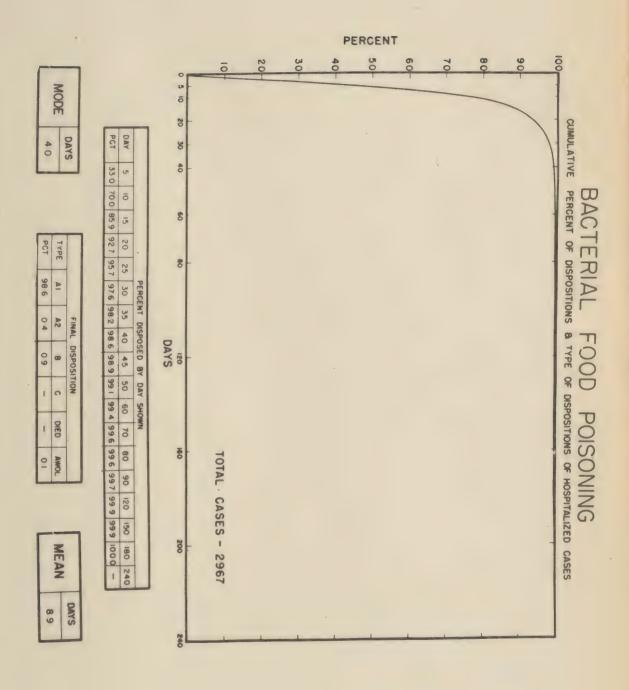


PERCENT L/B MODE ō 20 CUMULATIVE PERCENT OF DISPOSITIONS & TYPE OF DISPOSITIONS OF HOSPITALIZED CASES DAY 5 17 5 23 25 30 35 40 45 50 60 70 85 90 120 50 PCT 65 46 6 383 623 774 864 919 933 949 972 983 989 992 997 000 205 DAYS ષ્ઠ PNEUMONIA, PRIMARY (NOT ATYPICAL) å 8 8 PERCENT DISPOSED BY DAY SHOWN 70 FINAL DISPOSITION DAYS 6 8 000 DIED AWOL 02 60 TOTAL CASES - 1084 MEAN 80 24. 200 DAYS 73



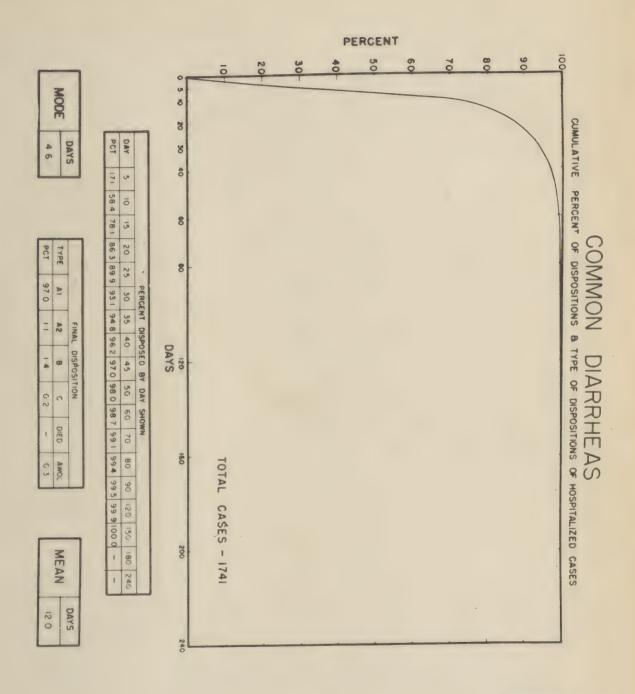


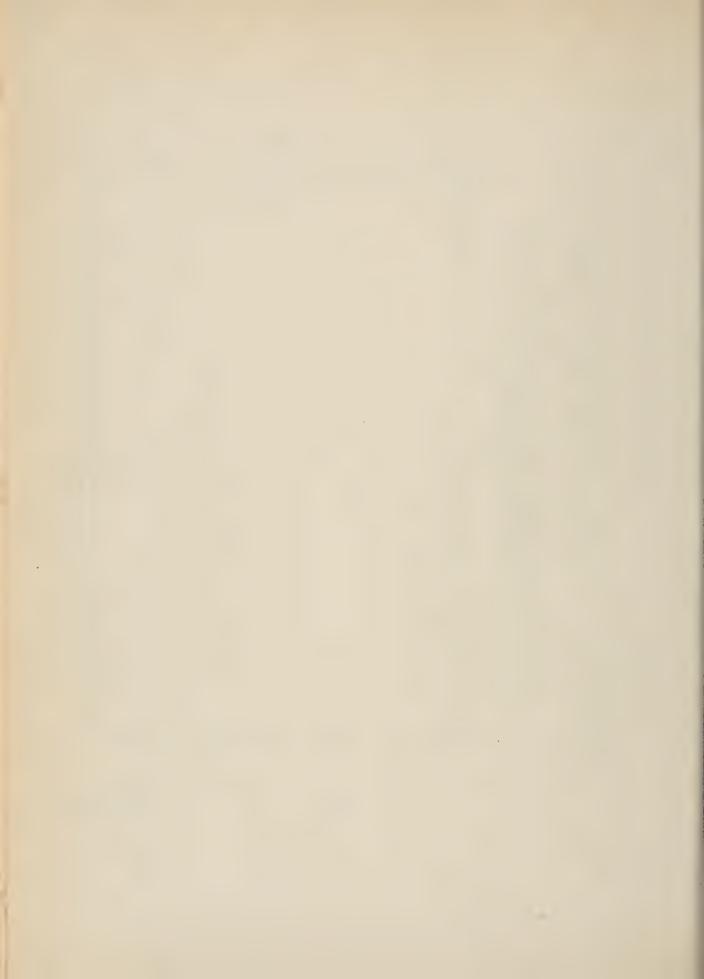


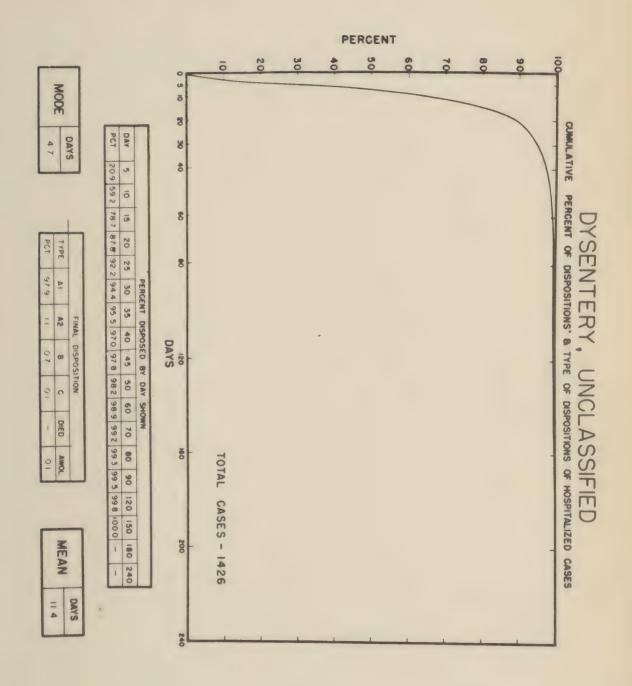


APPENDIX 17

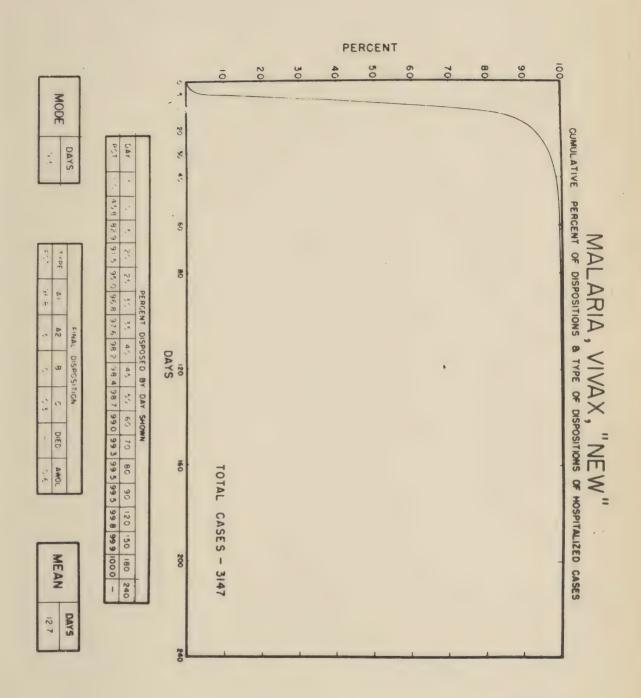




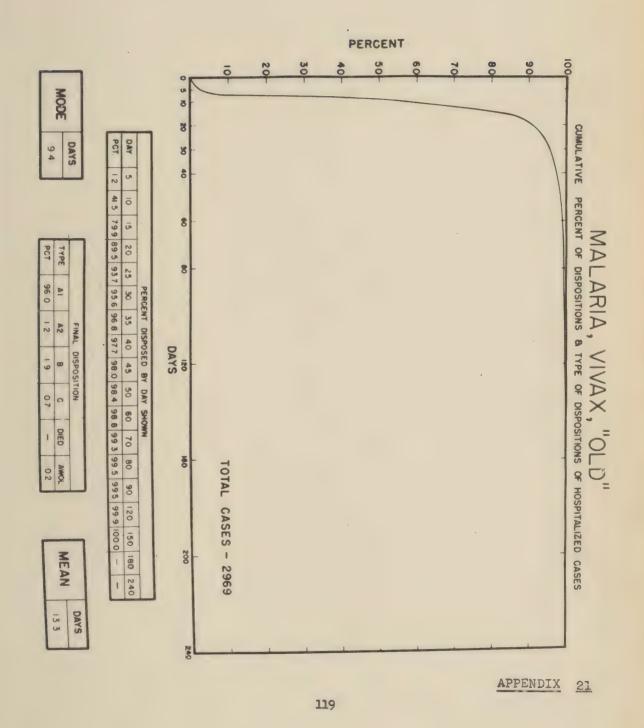




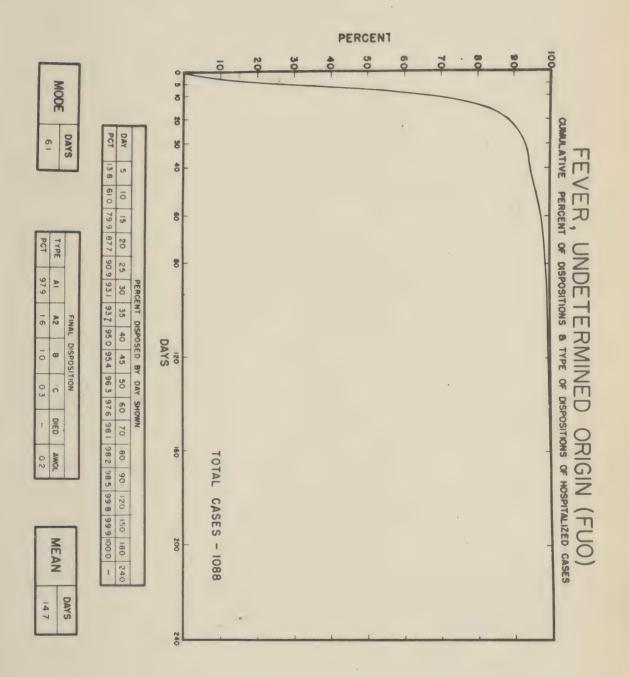




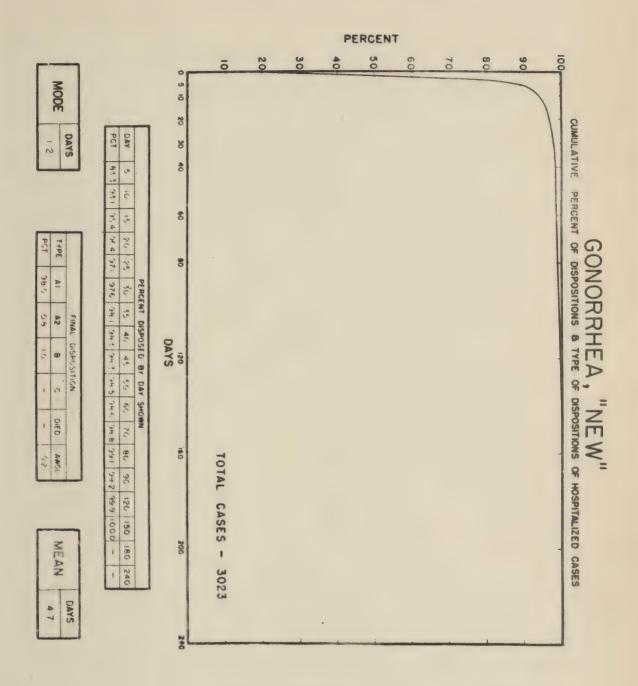




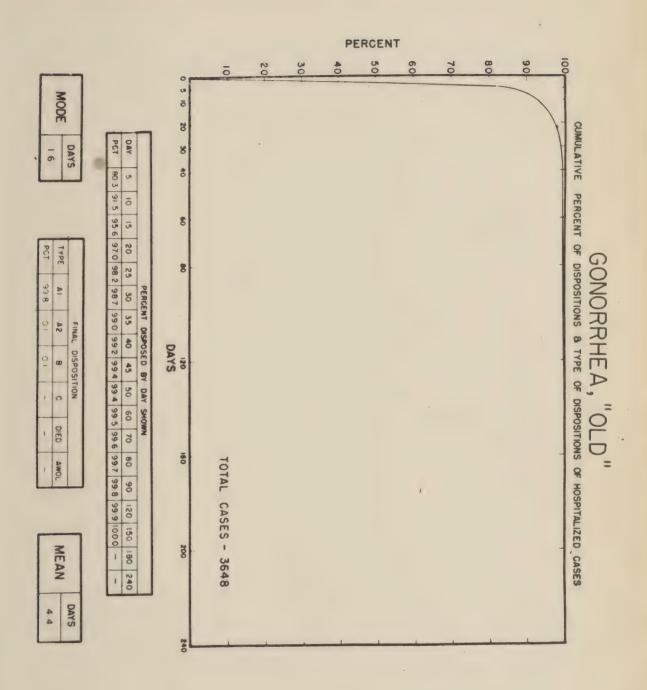




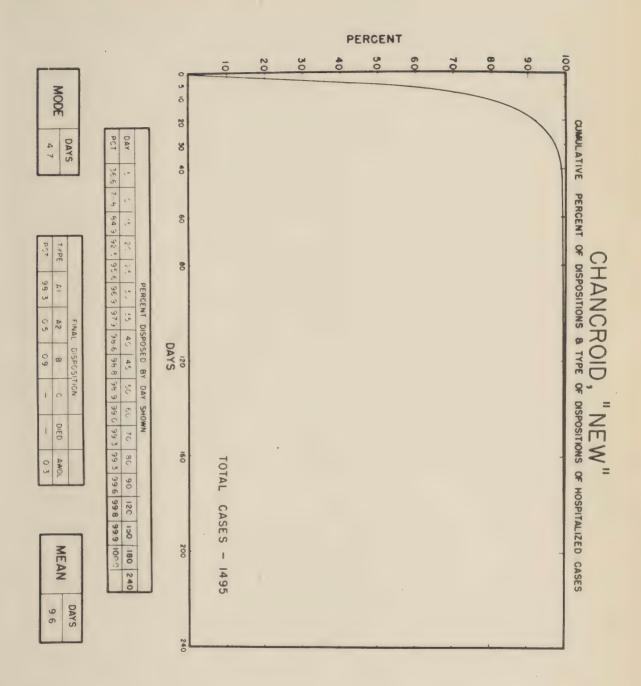




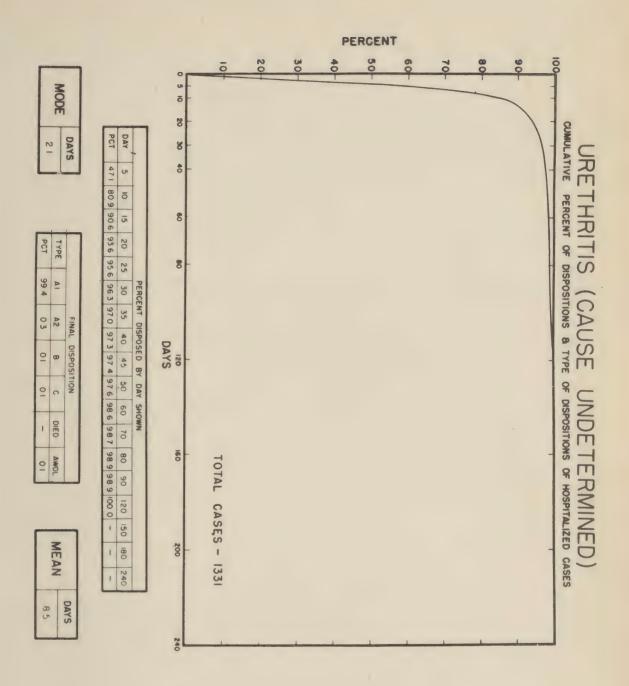




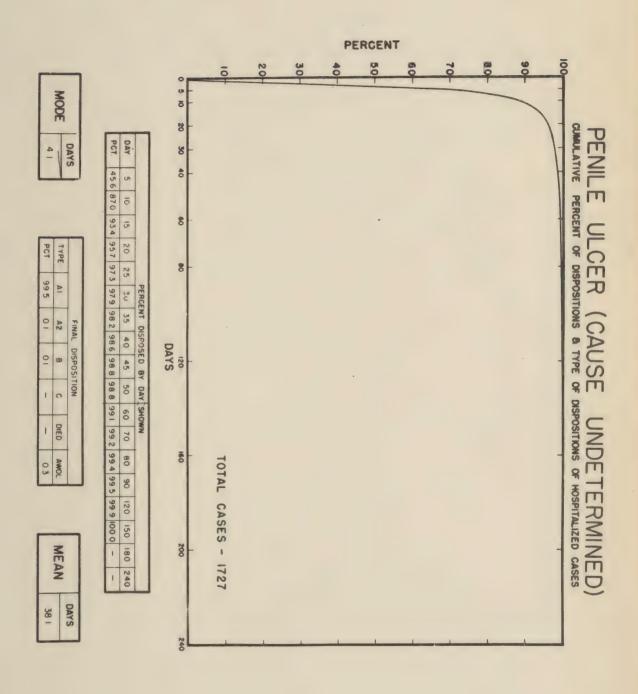


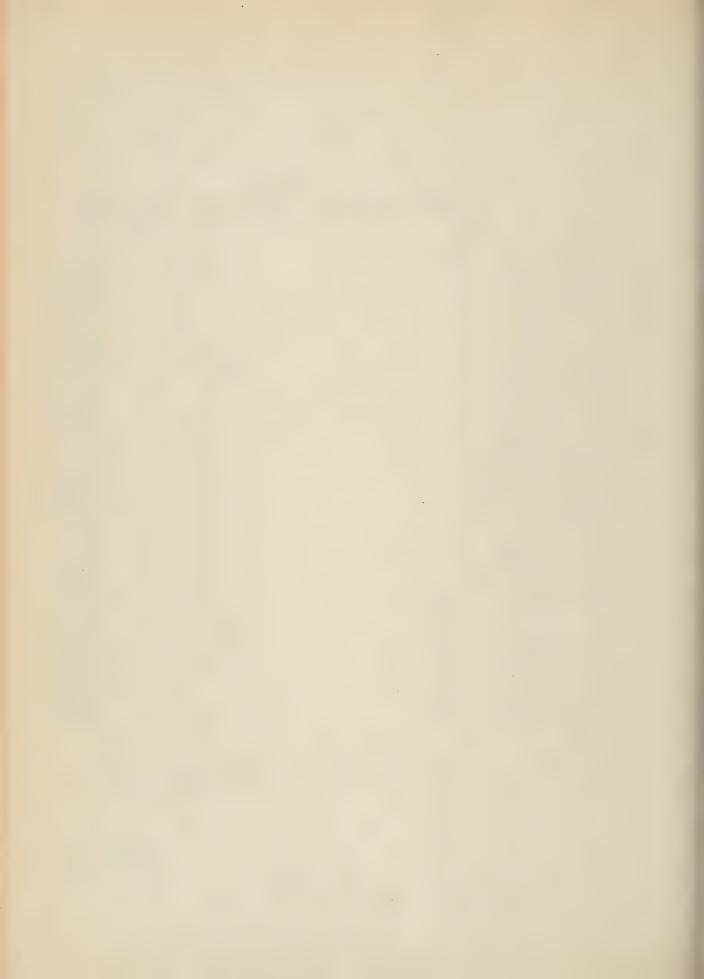


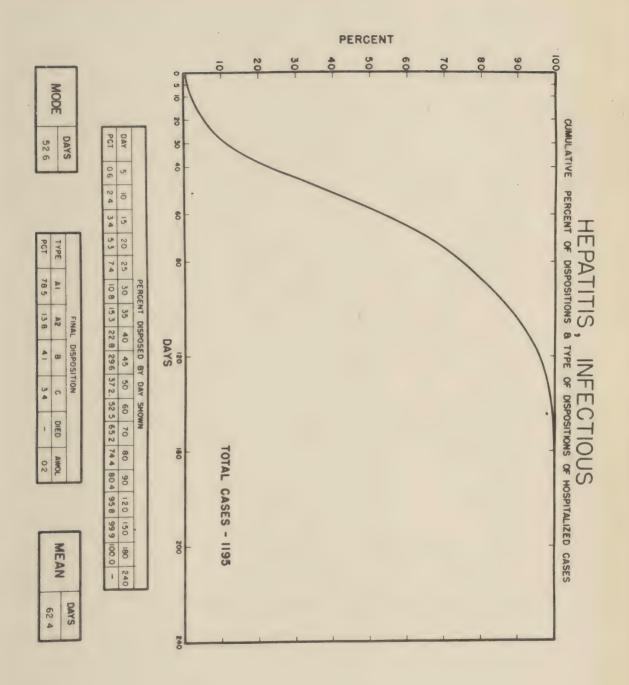




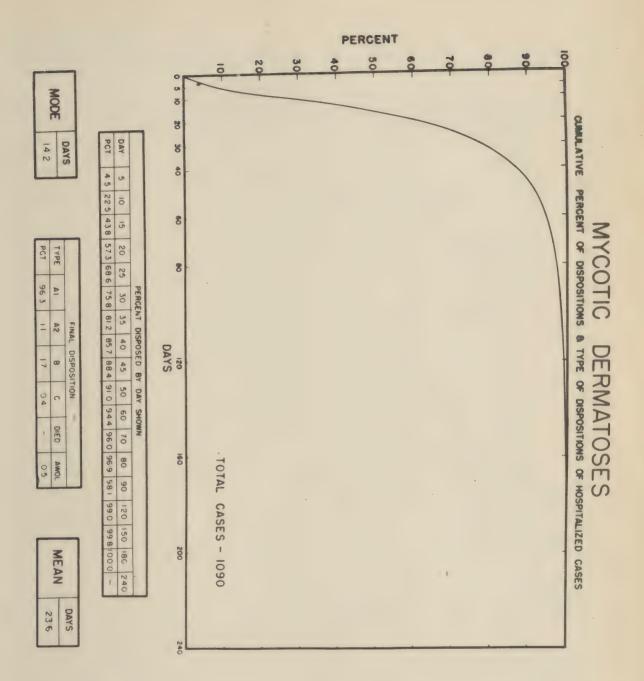














Civilian Food Handlers

	_											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOA	DEC	TOTAL
Salmonella napoli				2			3	1	4			10
S. orienienburg					1			1	5			7 6
S. paratyphi B	1	1		2					2			
S. schottmulleri							1					1
S. senftenburg										1		1
S. derby								}			1	1
S. typhi												
(E. typhose)			2			2	1					5
S. bareilly								1				
S. anatum			1									1
S. montivedeo			2									2
S. typhi-murium	1											1
S. tenesse				1								T
S. cholera-suis												
(var. knuns) F = I("\7")												
F = II("V")				1				1				2
F - III("E")				-				1				-
F - IV P 274				1			1					2
F - V(119)							-					
F - VI(Newcastle)		1				1	5	9	2	1		19
Boyd I (170)												
Boyd (274)IV		2				1	1	1	1			6
Boyd V(143)								1				1
Sh. alkalescens				1								1
Sh. sonnei				1	1	5	3	2	3	2	1	18
Sh. madamPensis-												
Ceylan B			1						1			2
Sh. ambigua												
(schmitzii)			1			1		1			2	5
Sh.Sp.Q771(Arab a)												
Q1167(" b)												
Q902								1				1
Total Positive	2	4	. 7	136	5	10	15	19	18	4	4	94
Paracolon-Proteus 3		18	83	136	83	248	463	299	245	189	97	1880
Negative 140	433	524	661	735	430	425	705	499	631	726	701	6610
Total 143	451	546	751	880	515	683	1183	817	894	919	802	8584
	1	1	-							1	1	

Appendix: 30

American Food Handlers

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Salmonella napoli S. montivedeo S. orienienburg S. typhi-murium Sh. sonnei Sacns Q771 F = II(*W*) F - III(*Z*) F = VI(newcastle) Sh. alkalescens) F = V (119) F = IV(103)	1	4 1 6		3	1	6	1 2 3 1 3	1 1 1	2	8		1 3	3 11 18 7 6 2 6 4 3 2 1
Total Positives Paracolon-Proteus Negatives	1 0 25	11 2 41	0 1 39	5 34 174	5 26 208	8 33 141	11 69 156	4 56 252	? 28 58	8 30 71	0 12 49	4 8 61	64 229 1277
Total	26	54	40	213	239	192	226	312	93	109	61	73	1640

Prisoners of War (German)

color deservant relacionate del l'amention del glipperson direction della qualification interne deservative discretive del del del deservant de del del del selection del del del del del della del	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Positives F - III Paracolon-Proteus Negatives			6	3 19	4			1					3
Total			6	22	4			1					33

Appendix: 30 (cont'd)

Hospital Patients

Contraction of the Contraction o			nie and and an analysis of				-						
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
S. napoli S. orienienburg S. Oregon S. paratyphi(Para A) S. schottmullerii(Pa S. seftenburg						1.	1	2		· 10			13 1 2
S. derby S. typhi (E. typhosa S. bareilly S. anatum S. montevedeo S. typhi-murium)	5	7	11	1	6	16			÷			41
S. tennessee S. cholera-suis (kunzendorf) F = I("v") F = II("w")		24	The state of the s	1	2		2						2 1 6
F - III("z") F - IV(P 274) F - V(119) F - VI(newcastle) Boyd I (170) Boyd (274)IV			The state of the s		1	1	1 3	8			1		2 12 1
Boyd V (143) Alkalaescens Sh. sonnei Sh. madampensis Ceylan B Sh. ambigua Sh. sp. Q771(Arab A) Q1167(Arab b Q 902		the bear employed configuration of the configuratio	The control of the co		1	Codes, or a contribution for the contribution of the contribution of the contribution of the code of t	2 1 1 1	6	eregeneden, generalgelig versen den Schenensche und zugen den Schenensche und der Sche				10 7 2 7
Total Positives Paracolons-Proteus Negatives	2	31 2 31	9 1 48	15 21 120	9 22 136	10 15 54	29 50 66	22 11 48	6	10 3 3	2 3 10	2 7	137 130 531
Total	2	164	158	1156	167	79	145	81	6	16	15	9	798

Appendix: 30 (cont'd)

Cases

-			-	-	A CONTRACTOR OF THE PARTY OF TH	-	-	_					Spinster, Spinst
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOA	DEC	TOTAL
1. Civilians (It.Food Handle Positive Pharacolon-Pro Negative	0	2 16 433	4 18 524	7 83 661	9 136 735	2 83 430	10 248 425	463	19 299 499	18 245 631	4 189 726	4 97 701	94 1880 6610
Total	1143	451	546	751	880	515	683	1183	817	894	919	802	8584
2. American Soldi (Food Handlers) Positive Paracolon-Prot Negative	1	11 2 41	0 1 39	5 34 174	5 26 208	8 33 141	11 69 158	56	7 28 58	8 30 71	0 12 49	4 8 61	64 299
Total	26	54	40	213	239	192	228	312	93	109	61	73	1640
3. Prisoners of V (Ger.Food Hand) Positive Paracolon-Prot Negative	lers)	000	006	0 3 19	O O 4	0 0 0	0 0 0	0	0 0 0	000	000	000	0 3 30
Total	0	0	6	1 22	4	0	0	1	0	0	0	0	33
4. Hosp & Disp Patients (Ameri-French) Positive Paracolon-Prof		31 2	9 84	12.1	9 22	10	29		0 0	10	2 3	0 2	137
Negative	2	31	48	120	136	54	66		6	3	10	7	531
Total	2	64	58	156	167	79	145	81	6	16	15	9	798
Grand Total			ter and an exercise To describe the	to Committee of Steel States									11035

Appendix: 30a

Percentage

-		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1.	Civilians (It. Food Handlers) Positive Paracolon-Proteus Negative	0.0 2.2 97.8	3.6	3.2	11,2	15,4	16,2	36,6	39,2	2.3 37.7 60.0	27.5	21.0	12.2	1.1 22.0 76.9
2.	American Soldiers (Food Handlers) Positive Paracolon-Proteus Negative	0.0	3.7	2.5	15.8	10.9	17.2	30.5	17.9	7.5 30.2 62.3	27.5	19.9	11.0	3.9 17.9 78.2
40	Hosp & Disp Patient (American-French) Positive Paracolon-Proteus Negative									0.0 0.0 100.0				

Appendix: 30b



APPENDIX 31 (omitted)



H E A D Q U A R T E R S
2655th MALARIA CONTROL DETACHMENT (OVHD)
Office of the Malariologist, MTOUSA
APO 512, U. S. ARMY

SUBJECT: Report of Malaria-control Activities in the Mediterranean Theater of Operation during 1945.

CLASSIFICATION CANCELIND Surgeon, AFHQ (American Section), APO 512, U. S. Army.

DATION 1 1948.

CAPITAIN V. B. TAYLOR, PG
Historical Division

/s/ Thomas H. G. Aitken THOMAS H. G. AITKEN, Major, Sanitary Corps, Malariologist, MTOUSA

Malaria Control

D. D. T.

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Per favore Non Rimuovere 135 Med. Serv. Det (Malaria Control)

DDT house sign used in Foggia area.

RESTRICTED

APPENDIX 32



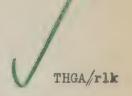


Application, by means of knapsack sprayer, of 5% DDT-kerosene solution to walls of enlisted men's barracks.



RESTRICTED

HEADQUARTERS
2655th MALARIA CONTROL DETACHMENT (OVHD)
Office of the Malariologist, MTOUSA
APO 512, U. S. ARMY



30 September 1945.

SUBJECT:

Report of Malaria-control Activities in the Mediterranean Theater of Operation during 1945.

TO: : The Surgeon, AFHQ (American Section), APO 512, U. S. Army.

- l. The following report is an account of the U.S. Amy military malaria control campaign in the Mediterranean Theater of Operations during 1945. Whereas theater headquarters personnel were responsible for the overall planning and administration of the program, actual supervision and accomplishment of operations were largely the responsibility of a small malaria-control organization. It is the intent of this responsibility of a small malaria-control organization. It is the intent of this respons to record the results of this program only through 30 September, inasmuch as large scale operations will cease at this time. For purposes of historic background, reference is made to the "Report of 1944 Malaria Control Activities in MTOUSA (NATCUSA)", submitted to the Surgeon, MTOUSA, by the Malariologist, MTOUSA, on 30 November 1944.
- 2. General policy and administration- Malaria control policy and general administrative procedure in MTOUSA originated in the Medical Section of theater headquarters with the Surgeon, the Chief of Preventive Medicine and the Malariologist.
- a. It seems unnecessary to go into a detailed discussion of policy and administration, inasmuch as these matters were very ably described in the 1944 report; suffice it to say that in general, policy and administration have remained the same. One notable exception has been the attitude adopted toward atabrine suppressive medication.

 Whereas last year the daily taking of atabrine was required with few exceptions throughout the theater, this past season has seen very little of the drug in use. The theater malaria directive (see Circular No. 54, 9 April 1945) calls for the taking of atabrine only in areas designated as malarious. With the exception of one instance in the Po Valley where 5th Army designated a few atabrine areas, the drug has been limited to an occasional unit having an unduly high malaria rate or to individuals recovering from an attack. Mosquito bars and repellant were available to troops from 15 April to 30 November.
- b. Estimates of malaria control supplies required in the theater during 1945 were submitted by the Malariologist to the Chief, Preventive Medicine Section in the Office of the Surgeon, MTCUSA early in the year; included in these were estimates of airplane requirements. Constant check of supplies on hand in various depots throughout the theater was maintained by the theater Malariologist and his associates, and shortages called to the attention of the Chief, Preventive Medicine Section.

RESTRICTED APPENDIX 32

RESTRUCTED

- c. Administration of the special malaria control organization was maintained by the theater Malarialogist through a small malaria control headquarters— 2655th Malaria Control Detachment (Ovhd). Movement and assignment or attachment of personnel or units was made, in general, on the basis of recommendations of the Malariologist to the Chief, Preventive Medicine Section. Activities of malaria control and survey units were reported weekly to the Surgeon of the responsible command. These were combined into monthly reports by the local malariologist and submitted through channels to the Office of the Surgeon, MTOUSA, with info mation copies being sent directly to the Theater Malariologist. In addition, the latter submitted to the Chief, Preventive Medicine Section a situation and status report on the 15th of each month.
- d. At the close of the 1944 season, when it was realized that the theater would shortly no longer have committments in North Africa or in the islands of Sicily, Sardinia and Corsica, it was decided that the malaria control organization could afford a drastic cut both in personnel and units. True, the theater was confronted with the problem of occupying the Po Valley, many sections of which are considered highly malarious, as well as remaining in the Foggia Plain and possibly the Grosseto area, but on the other hand, troops had moved out of such dangerous areas as Salerno, the mouths of the Volturno, Garigliano and Tiber Rivers and Litteria Province with its Pontine and Fondi marshes. As a result, the officer strength of 2655th Malaria Control Detachment (Ovhd) was cut from thirteen (13) to six (6), and the malaria units reduced from seventeen (17) to ten (10) control units and six (6) to one (1) survey unit. Redeployment of officers took place during the winter months.
- 3. Special organization for malaria control. This organization consisted of: 2655th Malaria Control Dat. (Ovhd), WD malaria control and survey units, and a small detachment from a ferrying squadron responsible for operating larviciding planes. For the relationship of these elements to the major subdivisions of MTOUSA, see Charts I and II.
 - a. 2655th Malaria Control Det. (Ovhd) and Theater Malariologist.
- l) This detachment, consisting of 5-6 officers and 7-8 enlisted men, acted as a malaria control headquarters for the theater. From it, malariologists were attached to various commands and from time to time malaria literature was distributed to interested personnel. Special research projects also stammed from this headquarters.
- 2) The commanding Officer, Major T. H. G. Aitken, Sn.C., was attached to the Medical Section of Theater Headquarters for duty as Malariclogist, being responsible to the Surgeon through the Chief, Preventive Medicine Section. Constant liaison was maintained with various parties responsible for the Allied malaria control program.

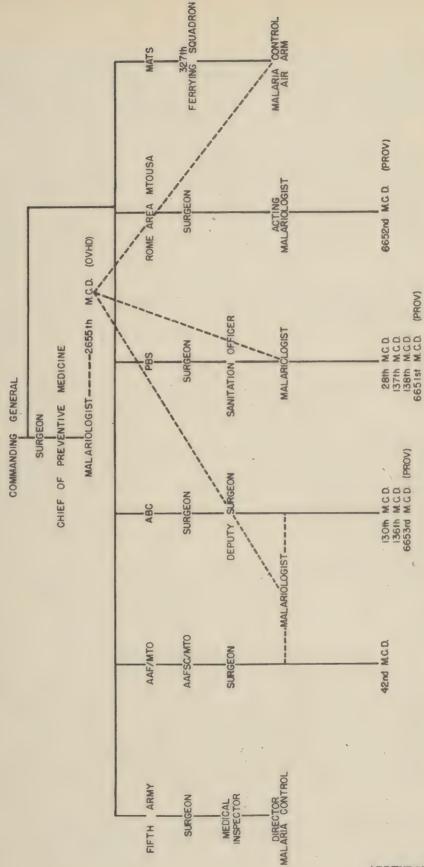
b. Local malariologists-

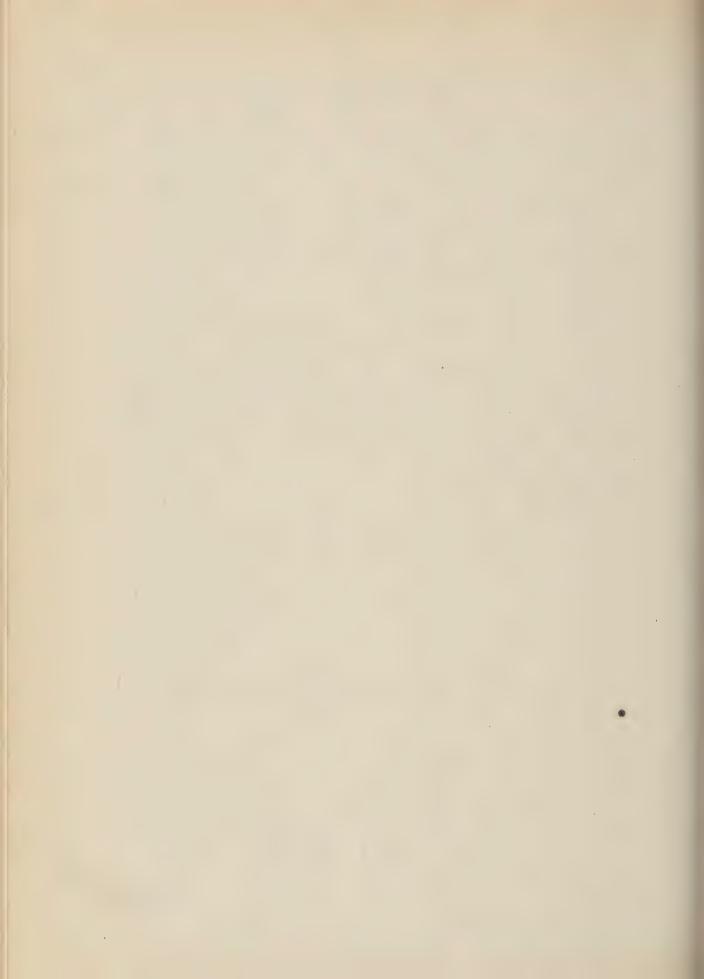
1) The remaining officers in 2655th Malaria Control Det.

327th FERRYING SQUADRON MALARIA CONTROL AIR ARM ROME AREA MTOUSA MALARIOLOGIST ORGANIZATION 133rd M.C.D. SURGEON MALARIOLOGIST ---- 2655th M.C.D. (OVHD) OFFICER MALARIA CONTROL MALARIOLOGIST 134th M.C.D. 137th M.C.D. 138th M.C.D. SURGEON CHIEF OF PREVENTIVE MEDICINE SANITATION COMMANDING GENERAL 1 JUNE 1945 CHART I. SURGEON RGEON 130th M.C.D. 135th M.C.D. 136th M.C.D. 139th M.C.D. SURGEON DEPUTY MTOUSA SPECIAL ---MALARIOLOGIST ---AAFSC/MTO 42nd MCD. AAF/MTO SURGEON MALARIA CONTROL ARMY 28th M.C.D. 206th M.S.D. MEDICAL SURGEON FIFTH APPENDIX 328



MTOUSA SPECIAL MALARIA CONTROL ORGANIZATION 1945 CHART I AUGUST





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(Owhd) were available for attachment to the Surgeon's Offices of various commands. They had technical direction of malaria units assigned or attached to their respective headquarters. With the restriction of control activities to the Italian Peninsula and the reduction in the number of major commands, fewer malariologists were required; furthermore, 5th Army provided its own malariologist (Director Malaria Control).

- 2) Major F. W. Whittemore, Sn.C., served as malariologist to AAFSC/MTO (Army Air Forces Service Command, Mediterranean Theater of Operations) from December 1944 to 15 October 1945. In April, after Adriatic Base Depot became ABC (Adriatic Base Command), he was further placed on TDY as malariologist with the Surgeon's Office, ABC, inasmuch as the areas occupied by the Air Forces and ABC in eastern Italy were in general the same.
- 3) Captain H. J. Dain, M.C., served as malariologist of PBS (Peninsular Base Section) from March until 30 August 1945, following which the position was assumed by the Chief, Preventive Medicine Section, PBS until the end of the season.
- 4) Major W. J. Wyatt, Sn.C., worked out of this headquarters on civilian ditching contracts during the spring and later devoted his activities toward improving the oiling and dusting planes and determining their output of larvicide per acre.
- 5) Major F. H. Connell, Sn.C., was attached to the Air Forces during January and February for the purposes of conducting laboratory technician schools dealing with the preparation and identification of malaria smears. He was assigned to 5th Amy Surgeon's Office from 1 March to 23 July 1945, after which he returned to this Headquarters and assisted Major Whittemore in the Foggia area.
- 6) lst Lt. A. Sulcov, MAC, assumed administrative responsibility for 2655th Malaria Control Det. (Ovhd) and assisted with the airplane larviciding program.

c. WD antimalaria units.

- l) Disbandment of units- As of 1 January 1945, there was a total of twenty-one (21) units in the theater, fifteen (15) control units (19th 23rd (incl.), 28th, 42nd, 130th, and 133rd 139th (incl.) and six (6) survey units 10th 14th (incl.) and 206th. As of 15 February, the ten (10) cldest units (19th 23rd control and 10th 14th survey) were disbanded by WD order, and all but three of the officers returned to the United States. Steps were taken to assign a considerable number of the enlisted men to the remaining units, either as vacancy replacements or as replacements for undesirable or inexperienced personnel.
- 2) Distribution Distribution of units during 1945 was as follows: (See Table I)

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TABLE I

Assignment and distribution of Malaria Control and Survey Units in MTCUSA. 1945

UNIT	ASSIGNED	ATTACHED	LOCALITY			
28th MCU 42nd MCU 130th MCU 133rd MCU 133rd MCU 135th MCU 135th MCU 136th MCU 137th MCU 138th MCU 139th MCU 206th MSU	5th Army PBS ABC Rome Area, MTOUSA PBS ABC ABC PBS PBS ABC 5th Army	AAFSC/MTO ABC (Advance) ABC (Intermed.) ABC (Intermed.) PBS (South) ABC (Intermed.)	Florence-Verona Pisa Cattolica Rome Antignano Cerignola Ramitelli-San Severo Naples Pisa Foggia Viareggio-Mantua			

a) During the spring, as a result of an unfortunate centroversy between the Air Forces and ABC as to the assignment status of malaria units, the 130th, 135th, 136th and 139th MCU's were tossed back and forth between the two commands. Effective 28 April, however, all four units were relieved of their attachment to AAF/MTO and reverted back to their assigned status to ABC. The two month old controversy resulted in a great deal of misunderstanding, the efficiency of the involved units was impaired and their activities curtailed because of the lack of labor.

b) In general the units remained in one area during the season. At the time of the spring offensive, the two Army units (28th MCU, 206th MSU) moved north into the Po Valley to Verona and Mantua from their bases in Florence and Viareggio respectively.

3) Redesignation of units- As of 29 March, units were redesignated as follows:

Former Designation

Present Designation

Medical Service Detachments (Malaria Control) Malaria Control Detachments

42nd 130th

134th - 139th (incl.)

28th Malaria Control Unit

133rd Medical Composite Platoon (FA)

206th Malaria Survey Unit

42nd

130th

134th - 139th (incl.)

28th Malaria Control Det.

133rd Malaria Control Det. 206th Malaria Survey Det.

4) Redeployment With the cessation of hostilities in northern Italy and the Declaration of Armistice, 9 May 1945, plans for redeployment of troops to the Far Eastern Theaters came into being; included in these plans were many of the malaria detachments.

a) Five (5) detachments left the theater early in July, one (the 206th M.S.D.) for indirect redeployment through the U.S.A., and

four (the 133rd, 134th, 135th and 139th M.C.D.'s) for direct redeployment to the Pacific.

- b) Three (3) detachments, namely the 28th, 136th and 137th, were scheduled for indirect redeployment early in September; however, the Japanese surrender provoked the decision to disband the detachments here in the theater.
- c) The remaining three (3) detachments, the 42nd, 130th and 138th M.C.D.'s are due to remain in Italy for another season.
- d) The loss of five (5) detachments in July resulted in considerable concern being registered over the security of the malaria program. The 206th M.S.D. was released by 5th Army to the Nontecatini Redeployment Training Center six (6) weeks in advance of its departure from the theater; while staging, however, it assisted the Training Center in its control program. Of the other detachments, the 133rd M.C.D. managed to continue its work around Rome up until a few days prior to departure, but the remaining three (3) (one in Leghorn and two in the Foggia area) cancelled their activities two weeks before leaving, thus exposing their areas to a possible build-up in anophelines. Fortunately, however, widespread DDT house-spraying undoubtedly played an important part in tiding over the critical period until new units could take over the area.
- In order to safeguard the program, authorization was obtained from MTOUSA to organize three (3) provisional units, namely; the 6651st M.C.D. by PBS, the 6652nd M.C.D. by Rome Area, MTOUSA, and the 6653rd M.C.D. by ABC (see MTOUSA letter, file AG 322/088 C-O, 27 June 45, subject: "Organization of Certain Medical Unita"). In addition, two (2) of these units, (6651st and 6653rd) were authorized an overstrength of fourteen (14) enlisted men (MTOUSA letter, file, AG 320.2/816 C-0, subject: "Authorization of Overstrength") and one (1) officer (MTOUSA letter, file, AG 320.2/816 C-0, 1 August 45, subject: "Authorization of Overstrength"), giving a total of twenty-five (25) enlisted men and two (2) officers. Activation of these units was as follows: 6651st M.C.D. (Leghorn) per G.O. #181, Hq. P.B.S., dated 3 July 45, effective 5 July 45; 6652nd M.C.D. (Rome) per G.O. #18, Hq. Rome Area, MTOUSA, dated 5 July, effective same date; and 6653rd M.C.D. (Foggia) per S.O. #44, Hq. ABC, dated 20 July 45, effective 23 July 45. Where possible an attempt was made to obtain personnel from the old units disbanded in the spring; this policy was about 30% successful.
- f) Labor- Authorization was obtained early in the season from MTOUSA (Letter, file, AG 370.5/188 Surg-C, 13 Feb 45, subject: "Theater Malaria Control Program"), providing each malaria unit with two (2) Italian labor companies (approximate strength per company 100 men), the responsibility for compliance being that of the major command to which the unit was assigned. With the activation of the three (3) provisional units in July, the above latter was amended to include the new units (see MTOUSA letter, file, AG 370.5/188 Surg-O, 12 July 45, subject: "Theater Malaria Control Program"). Shortly following the activation of the 6653rd M.C.D. (Prov), it turned back

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its Italian labor, substituting for it German POW's who proved to be vastly superior to their predecessors.

- g) Excess Equipment- In order to provide adequate equipment over and above that listed in T/O & E 8-500, War Dept., 18 January 45 for malaria control and survey detachments, authorization was obtained from MTOUSA (Letter, file, AG 400.34/188 D=O, 20 March 45, subject: "Special Issue of Equipment to Certain Medical Units") to draw excess equipment to be used by the Italian labor companies between 15 March and 15 November 45. This authorization was amended in July to include the 6651st, 6652nd and 6653rd Malaria Control Detachments (Prov) (AFHQ cable, AG29453, time of origin, 071437B). This very generous list made it possible for the units to work unhampered at all times during the season, and avoid much loss of time and red tape, which otherwise might have been caused in trying to obtain additional vehicles or special pieces of equipment over and above the authorized T/O & E.
- d. Airplane dusting and spraying organization- Airplane larviciding operations were undertaken by a small group of American pilots and enlisted men from the 327th Ferrying Squadron, MATS (Mediterranean Air Transport Service) under the technical supervision of the Theater Malariologist and his designated representatives. This arrangement, as in 1944, was requested by the Commanding General, MATS, and concurred in by the British Consultant in Malariology, AFHQ and the Tropical Disease Consultant, RAF.
- 1) Personnel- This consisted of nine (9) pilots and eighteen (18) enlisted men (ground crew). At no time were more than six (6) pilots operating planes. Of the remaining three (3) pilots, one departed the theater early in the season after supervising the modification of the first planes, and the other two temporarily replaced regular pilots for short periods.

2) Equipment-

2 L-5 observation planes
3 PT-17 (Stearman) planes
2 equipped for dusting
1 equipped for oiling
10 A-20 (Boston) light bombers
6 equipped for oiling
4 equipped for dusting
2 1/4-ton trucks
2 1/4-ton trailers

Originally all three Stearmans were equipped for dusting, but during July one was modified into an oiler in order to overcome the difficulties and dangers caused by the very light diluent (diatomacious earth) blowing up into the face of the pilot; in addition, the modification permitted the plane to carry a larger load and operate farther from its base.

2) <u>Distribution- Two</u> advance bases were set up in northern Italy, leaving Capodichino Airfield, Naples (Hq. 327th Ferrying Squadron)

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as the home port. One group (3 pilots, 10 enlisted men, 1 L-5, 1 PT-17, 3 A-20 cilers, 2 A-20 dusters, 1 1/4 ton truck and trailer) established itself on Rimini Airfield and operated in conjunction with the 130th Malaria Control Detachment and the other group (same equipment and personnel except that there were eight enlisted men) established itself on Rosignano Airfield and lived with the 134th Malaria Control Detachment near Leghorn. Later in the season it became necessary for the Rimini group to move its planes to Cattolica Airfield and again to Villafranca Airfield, Verona; likewise the Leghorn group was required to move its planes to Pisa Airfield, however, loading of larvicide continued to be done at the Rosignano Airfield. The third PT-17 was left as a reserve at Capodichino Airfield.

4. Summary of Theater-antimalaria activities.

a. Antimalaria education program—Inasmuch as many persons connected with the malaria control program had received rather extensive training (involving W.D. Courses #1, 2 and 3) during the 1944 season, it was felt that a comprehensive school program was unwarranted in 1945. As a result, the Theater Malariologist in January, after discussing the matter with local Malariologists, proposed to the Chief, Preventive Medicine Section, Office of the Surgeon, MTOUSA, a modified educational program. This consisted of one day schools, given by the local malariologists and his assistants, for: a) officers entrusted with antimalaria instruction of troops, b) officers who supervise the activities of organizational EM antimalaria details, and c) EM of the organizational antimalaria details. In the main, schools were held during March and April, just before the start of the mosquito season. In general, the following aspects of the malaria problem in MTOUSA were covered:

1) Officers' schools:

- a) Outline of history of malaria in (MATOUSA)
 MTOUSA during 1944, with particular reference to the major command involved.
 - b) Analysis of the Theater malaria hazard for 1945.
 - c) Nature of control problems to be expected in 1945.
- d) Duties of antimalaria personnel (Malariologist, WD Malaria Control Units, Commanding Officers, Malaria Control Officers, EM Antimalaria Details) and their relationship to one another.
- e) Antimalaria education of troops (scope, sources of teaching aids, training films).
 - f) Training and use of antimalaria details.
- g) Supplies and equipment (how and where obtained, T/BA, stock numbers, etc.)
 - h) Suppressive atabrine Theater policy, 1945.

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TABLE II

Summary of malaria-control training activities in MTOUSA by special malaria control organization

		COURSI	ES			
COMMAND	GENERAL		TECHNI	ICIANS		
	Officers	E.M.	Officers	E.M.		
AAF/MTO & ABC	855	1030	89 ~	97		
PBS	484	856		. dile dile		
Rome Area, MTOUSA	30	110	60 w	600 CDD		
5th Army	888	1691	0000	City too		
MTOUSA	2257	3687	89	97		
Grand Total		6 7	1 3 0			

2) EN Schools-

- a) Importance of malaria general sketch utilizing "Graphic Portfolio on Malaria" (WD Graphic Training Aid 8-4).
- b) Description of mosquitoes (anophelines and culicines) and their biologies.
- c) Malaria control measures which will actually be practiced by FM antimalaria details.
 - d) Care and use of equipment.
- e) Field trip to demonstrate collection of mosquitoes, house spraying, oil larviciding and ditching techniques.
- 3) In addition to the above schools, Major Frank H. Connell, Sn.C., of this Headquarters, conducted in January and February a series of schools for officers and technicians in Air Force Group Aid Dispensaries. This was a highly necessary move as the Air Forces were in the process of equipping their medical units with microscopes, and the majority of the personnel were inexperienced in the preparation and diagnosis of malaria smears.
- 4) School locations- Schools were held in Naples, Rome, Grosseto, Siena, Leghorn, Pisa, Florence, Cattolica, Torre Maggiore, Foggia, Cerignola, Spinazzola, Bari, Manduria and in the mountains of the 5th Army Sector north and west of Florence.
- 5) Attendance According to the local malariologists' reports, 6,130 officers and enlisted men received training, as shown in Table II by course and Command. This amounts to about 1.2% of the total American strength at the time the schools were conducted, and represents

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the same contact with the troops as was obtained in 1944. It is difficult to evaluate the success of such undertakings, but judging from the well organized programs conducted by certain units, certainly some benefits must have been derived from attendance at the schools.

b. Survey activities-

- l) <u>Case investigation</u>— As was the procedure last year, malaria statistics accumulated by the local malariologists during the 1945 season, have in certain instances differed markedly from those computed by the theater. The method of reporting by the malariologist varied with the different commands.
- a) Fifth Army malariologist reported the total number of cases based on the weekly statistical health report plus cases reported by base hospitals. Since some cases of malaria in Army personnel are first diagnosed in base hospitals and therefore do not appear on Army weekly statistical health reports base hospitals were requested to notify Army of all such cases so that they might be added to the weekly statistical health report figures. A breakdown by species was obtained by a review of field medical records and emergency medical tags.
- b) PBS malariologist reported total cases based on daily hospital reports of positive diagnoses. Cases were broken down into primary and recurrent infections, type of infection and origin. It was thus possible to follow the history of a particular unit, and, if an undue number of cases appeared, to take the necessary steps to overcome the situation. Comparison of these figures with those of the consolidated monthly 86ab report has shown the two consistently to be equal or approximately so. Hence the theater and malariologist rates for the Base Section are essentially the same. Inasmuch as with few exceptions, hospitalization of all Base Section personnel takes place in its own hospitals, the malaria rates reported by the malariologist are as close an approximation as it is possible to obtain.
- c) Rome Area, MTOUSA malaria rates were computed on the basis of individual case histories obtained by the malariologist from the hospital wards.
- d) ABC malariologist reported total cases based on consolidated monthly 86ab reports.
- e) AAF/MTO malariologist reported total cases based on consolidated monthly 86ab reports as well as individual unit 86ab reports. This system has been necessary inasmuch as many Air Corps unit dispensaries diagnose and treat their own cases locally. In addition, the malariologist monthly culled out Air Corps cases hospitalized in various sections of Italy, and which otherwise would have been overlooked. As a result, theater rates have never jibed with those of the malariologist, but it is felt that the latter's figures more closely approximate the actual situation.

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TABLE III

Summary of malaria case investigations in MTOUSA by special malaria-control organization from 1 January to 31 August 1945

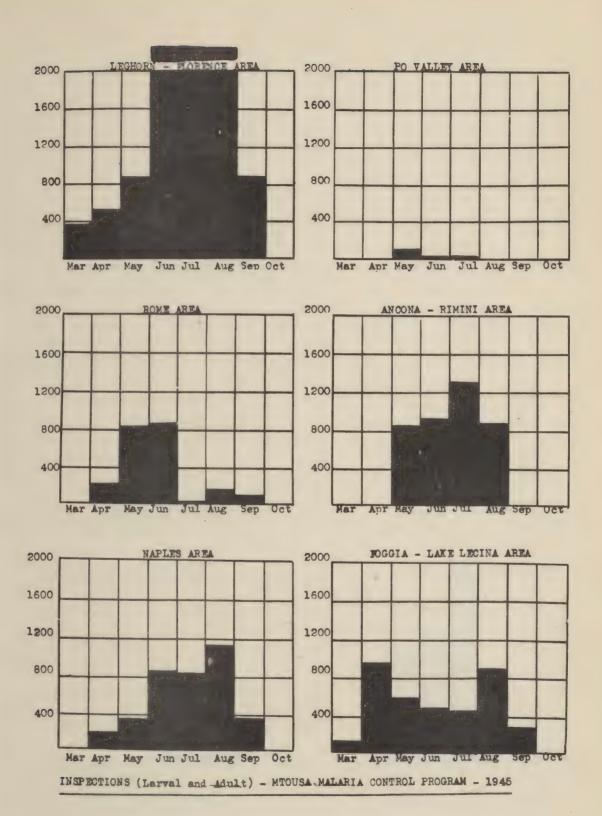
essider veccuvatar-vessige figurance principal		1	UMBI	ROF	CAS	ES	ALCONOMICO COMMISSIONICO CO COMMISSIONICO COMMISSIONICO CO					
COMMAND	Reported			ttack		By diagnosis						
			Primary	Recur= rent	Clin- ical	Vivax	Falci- parum	Malar- iae	Unde- termined			
AAF/MTO	2034	2034	1158	876	146	1803	58	4	23			
ABC*	53	53	37	16	- 3	45	4	0	1			
5th Army#	1940	1323	857	1073	145	1156	3	0	19			
PBS	860	353	308	552	1	348	0	0	4			
Rome Area.	10	10	4	6	0	10	0	0	0			
MTOUSA	4897	3773						quaddon-Cov				
Attacks	4897		2374 48%	2523 52%				D. Coloredo				
Diag.	% of Total Above Diag. 3773		40/0	1)26	295	-	The second secon	478	AND STREET, ST			
% of To					8%			92%				
Types	3478					3362 96.6%	65	0.1%	47			
0 OI 10	% of Total above . 96.6% 1.9% 0.1% 1.4%											

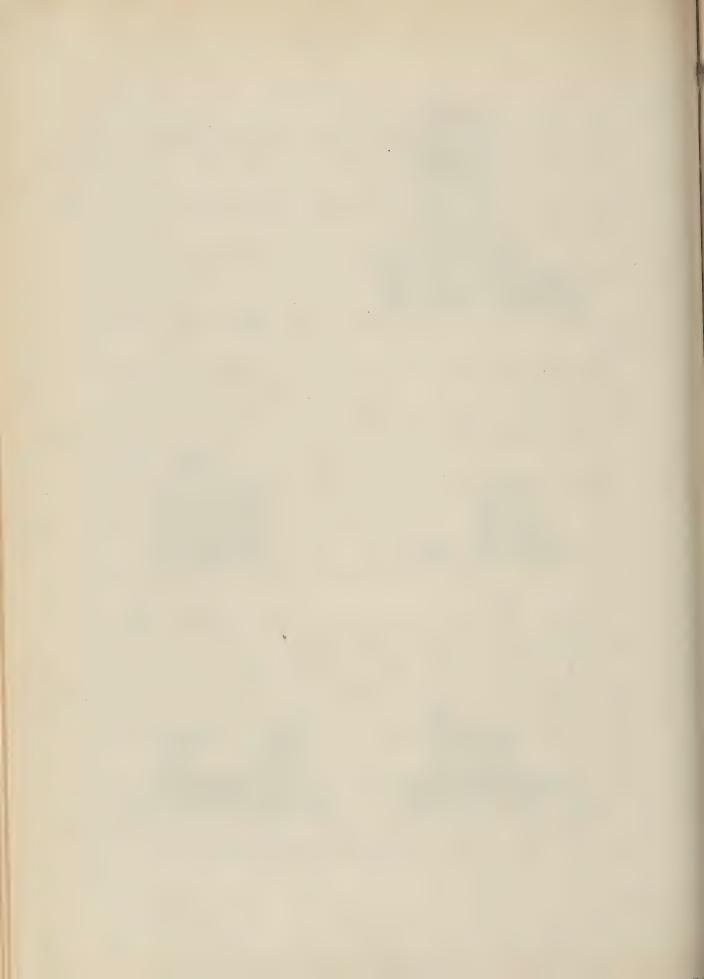
*No reports for January and February #No report for August

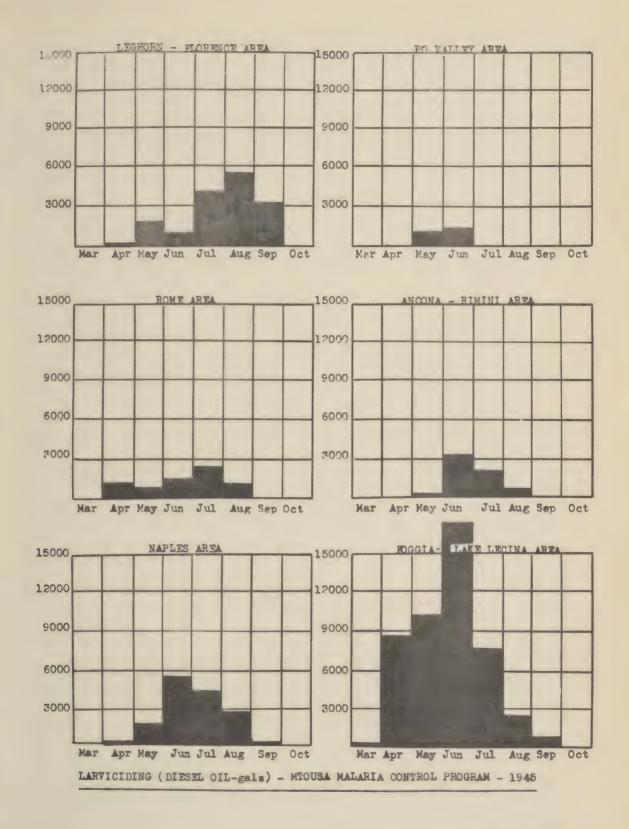
by malariologists for the first eight months of the year is about seventeen hundred less than the number shown in the official statistics for the same period. The reason for the difference is due to the fact that several of the smaller commands are not included; also no report was forthcoming from the malariologist 5th Army for August. Nevertheless, the forty-eight hundred cases reported, constitute a large sample of the actual total, and give a good idea of the 1945 malaria experience.

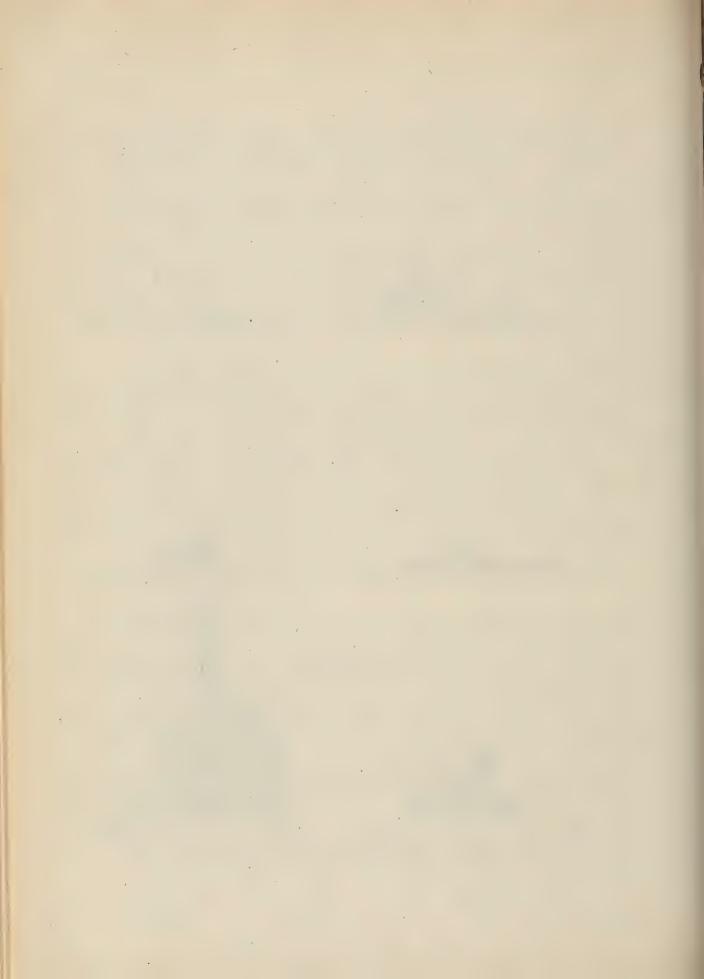
g) Recurrent malaria- Table III indicates that of 4897 cases 52% were "recurrent" infections, i.e., the patients gave a history of one or more attacks during the previous six months. It is to be expected that some of these attacks may have been initial infections, as there is no reason to suppose that an infected person is not susceptible to a different strain of Plasmodium.

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- h) Primary infections- Obviously not all of the 2374 cases listed as primary infections in Table III can be credited to transmission this season. From January through May, local malariologists reported 1,683 primary infections in the five major commands listed in Table III. Although a few of these could possibly have been true winter or spring infections, the great bulk of them must of necessity have been incurred during the previous fall months. Such delayed or latent primary infections are characteristic of Plasmodium vivax, which was responsible for about 90% of last season's malaria cases.
- i) Clinical diagnosis- Table III indicates, that where this information is available, clinical diagnosis without benefit of laboratory confirmation occurred in only 8% of 3773 cases. Schools for medical officers held both last season and again this spring have undoubtedly played a significant role in keeping the clinically diagnosed cases to a minimum.
- j) Types of malaria- In conformity with last year's experience, the 1945 season has seen an overwhelming preponderance of vivax infections. Tertian malaria parasites were found in over 96.6%, subtertian in 1.9%, quartan in 0.1%, and in the remaining 1.4% no specific diagnosis was made.
- 2) Splenometric and parasitologic- No such surveys were made of the civilian population this past season, due to the fact that all but one survey unit were deactivated in the spring. For lack of sufficient units, the one remaining survey unit operated in the capacity of a control unit. It is felt, however, that little was lost by not continuing such surveys, as the troops have in general occupied the same areas where they were last year and a fairly good idea of disease conditions in the civilian population was known. With the exception of large cities and mountainous areas, a country such as Italy should be considered malarious from the military standpoint, regardless of the results shown by a few minor surveys.
- trol units this past season were forced to train their own survey teams. Each unit in general had two men assigned to inspection service. Larviciding schedules were developed on the basis of entomological findings; in this manner, unnecessary larviciding was eliminated as only anopheline positive areas were treated. A standardized system of mapping control areas and recording information, which was adopted by all units at the start of the season, made it possible to obtain uniform results as well as making it easier for the malariologists to keep close check on the progress of operations. In the absence of diagnostic equipment, it was impossible to specifically differentiate anopheline larvae and adults. Suffice it to say that about 98% of the adult captures were members of the Anopheles maculipennis complex. A few Anopheles claviger were seen early in the season and on one or

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two occasions Anopheles superpictus was caught. Larval and adult inspections in the six different regions of control are summarized in Graph I. The graphs for the Leghorn and Foggia areas represent the work of three units each, that of the Po Valley involved two units, and elsewhere the graphs represent the activities of individual units. The season's work can be summarized as follows: of 21,764 inspections for larvae, aquatic areas were 9% positive for anophelines and 12% positive for culicines; 3,553 adult inspections were 22% positive for anophelines and 20% positive for culicines.

c. Control activities - The summaries herein reported, refer only to the work accomplished by units of the theater's special malaria control organization. Obviously it is impossible to give consideration here to the accomplishments of individual anti-malaria details.

1) Larviciding.

a) General- The season's total larviciding accomplishments have been summarized according to command in Table IV. Reference is made to Graph II (hand larviciding only), which shows how the work varied in the different areas of occupation. It will be seen that the greatest amount of hand larviciding was accomplished in the Foggia area where three units were operating. Elsewhere in Italy, the graphs generally reflect only the work of individual units.

TABLE IV

Summary of larviciding activities in MTOUSA by special malaria-control organization from 1 March to 15 September 1945*

COMMAND		I DESCRIPTION OF THE PROPERTY	Man		
	Area Covered (sq. yds.)	Pure Paris green (pounds)	Diesel cil (gallons)	DDT (pounds)	days
AAF/MTO & ABC	573,894,836	44,410	56,599	16,147	3242
5th Army	1,134,457	CORP CORP	2,060	244	452
PBS	388,214,720	38,228	68,047	17,088	1996
Rome Area, MTOUSA	149,509	(2) (2) (2)	7,469	1,786	415
TOTAL.	963,393,522	1 82,638	134,175	35,265	6105

*Note: Airplane larviciding figures included.

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Although three units were also present in the Leghorn area, one of these carried on little or no larviciding activities as it was operating largely in an advisory capacity to Air Corps anti-malaria details. Likewise, most of the larviciding in the Leghorn area was accomplished from airplanes because of the danger of land mines; reference is made to Graph V for results of this work.

- Paris green- With the exception of a relatively small amount of dust which civilians (under PBS control) applied by hand in the Grosseto area, all Paris green used in the theater was distributed by airplanes (see Graph V). Diluents consisted of distomacious earth or cement; during the six months period (April - September) 91,108 pounds of Paris green (Pure) were expended. Inasmuch as last season's experience demonstrated that unit anti-malaria details showed no interest in using Paris green, preferring oiling methods instead, no attempt was made to discuss the subject in the malaria schools conducted this past spring. Notwithstanding the fact that an organization such as the Rockefeller Foundation has amply demonstrated the merits of anopheline larval control by means of hand casting Paris green (i.e., eradication of Anopheles gambiae from Brazil, largely by this method), the writer is inclined to believe that the average G.I. will do a more effective job of control using a knapsack sprayer full of oil rather than try to learn something about the application of a toxic insecticide he knows nothing about.
- Diesel oil and DDT- Larvicide of choice was diesel oil, of which there were 134,175 gallons applied during the season. Airplane larviciding (as 5% DDT in diesel oil) accounts for 54% of the total oil output; while most of the hand larviciding operations were accomplished with straight diesel oil, 20% of the total oil dispersed manually contained DDT as a 5% mixture. Unfortunately, no data is available to show how long the DDT applications were effective; undoubtedly some residual effect established itself after several applications to the same breeding area. DDT, as a 2% dust (in talc) was broadcasted by hand in several marshy spots in the Foggia area with apparent good effect. With regard to airplane dispersal, oiling schedules were of a necessity placed on a weekly basis regardless as one could never be certain that a particular canal or marsh had been completely covered because of wind deflection or obstructions such as wires, trees, etc., which would later the course of the plane. Reference is made to Graphs II and V showing the amounts of oil used in different sections of Italy.
- 2) Adult spray-killing- This measure was perhaps the most important item used in mosquito control operations during the past season. Table V shows the results of activities of special malaria control personnel as reported by local malariologists. It should be pointed out that these figures represent only a portion of the total

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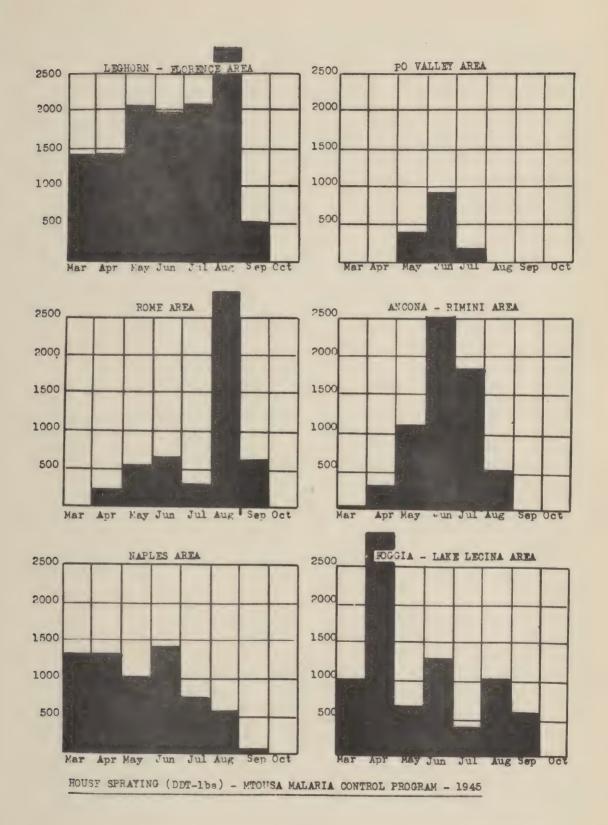
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TABLE V

Summary of adult spray-killing activities in MTOUSA by special malaria-control organization from 1 March to 15 September 1945

COMMAND	Freon Pyrethrum	DDT	Number of Ro	Labor	
	(pounds)	(pounds)	Military	Civilian	(Man days)
AAF/MTO & ABC	0	18,137	4,467	64,694	3,515
5th Army	1716	1,848	111	51,848	1,933
PBS	0	15,361	47,828	42,323	6,879
Rome Area,	0	5,389	4,593	19,091	1,440
TOTAL	1716	40,735	56,999	177,956	13,767

output of insecticide used, for individual organizations were responsible for spraying within their own bivouac areas, and those in rural sections sprayed all houses within a mile and a half radius of camp, the malaria control units picking up from this point and extending the control area to the two or two and a half mile point and sometimes farther. It is interesting to note the drop in Freon-Pyrethrum Bombs over last year, whereas in 1944 special malaria control personnel used 11,217 bombs, only 1,716 bombs were reported used in 1945, and these by Army units during the Po Valley offensive when it was necessary to treat houses quickly; later the unit went back and resprayed the houses with DDT. After the phenomenal results obtained with DPT as a house spray late last season. plans were early formulated for an extensive program in 1945. As far as this theater is concerned, 1945 can be remembered as a DDT year. Whereas last season some 12,000 pounds of DDT were applied to walls by malaria control units, over 40,000 pounds of DDT were applied by similar units during 1945. Spraying the 5% DDT kerosene mixture commenced, in general, in March in order to kill the overwintering anopheline females. After the initial spraying, unit buildings were resprayed monthly and the surrounding civilian houses about every three months. Later in the season it was felt that it would be more profitable to increase the protected zone by another half mile to a mile rather than respray previously treated houses; in this way very large areas of countryside were "blanketed" with DDT. It was also discovered, that in order to get adequate control, it was necessary to treat every shelter in the control zone, otherwise small foci of adults continued to exist in the untreated shelters. In a few instances, however, it was necessary to restrict the





amount of spraying. For example, in certain sections of the Po Valley where sericulture is in existence. DDT was applied only to civilian pigsties, stables and other out houses, as the silk worms which are raised in the houses would otherwise have been destroyed. Graph III shows the relative amounts of DDT applied by special malaria control personnel in different areas of Italy. Stocks of commercially prepared 5% DDT in kerosene solution were augmented by others prepared within the theater by malaria control units and distributed to organizations in 5 and 50 gallon containers. One of the malaria control units with PBS, which was responsible for mixing larvicides for the airplane operations, undertook to supply the Base Section Quartermaster with 5% DDT kerosene mix. During the season, the plant at Rosignano produced 68,470 gallons of 5% DDT in kerosene, which was furnished to PBS, Army and to some extent 12th Air Force units. In addition the plant produced 135,566 gallons of 5% DDT in diesel oil and 245,465 pounds of Paris green mix for airplane larviciding purposes. Although DDT house spray was distributed on the basis of 30 gallons per 1000 men per month, it was always available and units needing additional amounts could always draw it.

struction, cleaning and maintaining are shown in Table VI. Again the work accomplishment of anti-malaria details is not included, but in this case the amount would be negligible. In three areas, namely Leghorn, Naples and Foggia considerable reliance was placed on civilian contract work. The extensive canal system in the Leghorn - Pisa area was badly in need of maintenance. Unfortunately the local malariologist was late in assuming his duties, and it wasn't until the latter part of May that the necessary appropriations were approved permitting the letting of contracts and initiating the work. Although these projects have been classified under malaria control, some of them were obviously flood and storm control projects and an undue amount of labor was utilized; however some material benefits resulted in any event. Graph IV roughly illustrates work accomplishment in various parts of Italy.

a) Labor- Early in the season MTOUSA authorized each malaria control unit two Italian military companies. These usually consisted of two officers and about 112 enlisted men; these were organized as Sanitary Companies, Quartermaster Companies or Air Service Companies. Due to the inherent nature of the Italians, this labor wasn't too satisfactory. One or two of the malaria control units had better success by hiring civilians locally. In July, the units assigned to ABC turned back their Italian labor and in turn were furnished German POW's; these men were greatly superior to their predecessors and far outclassed them in amount of work accomplished.

RESIGNATED

TABLE VI

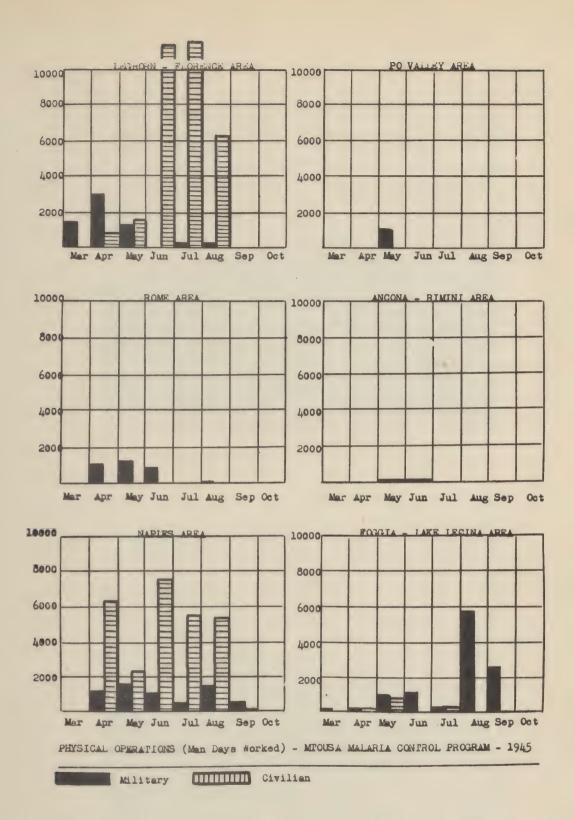
Summary of physical malaria control operations in MTOUSA by special malaria control organization from 1 January to 15 September 1945

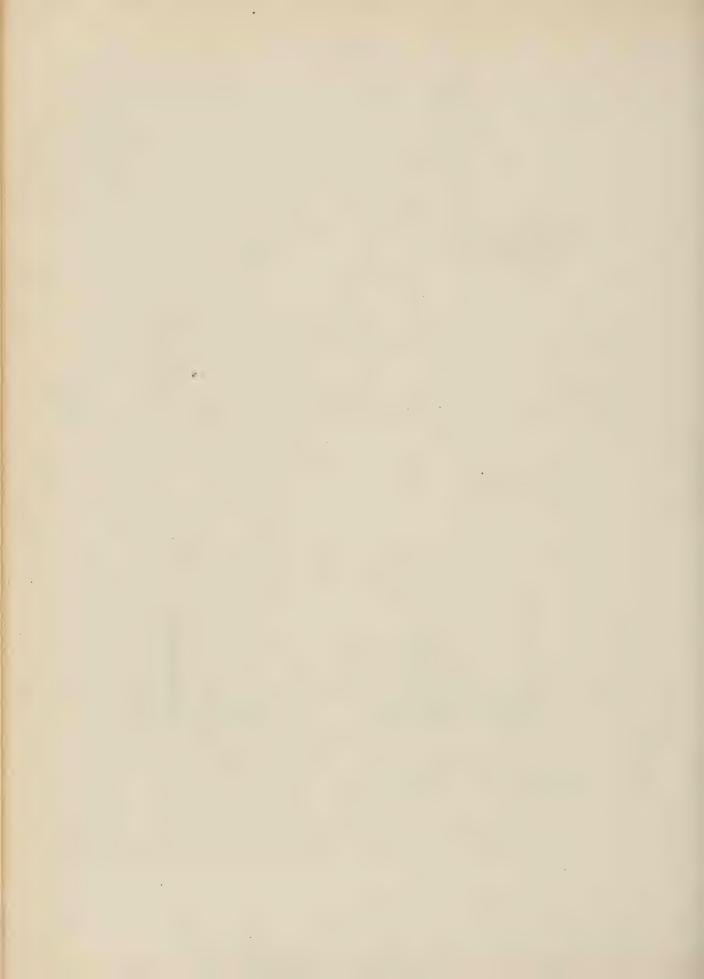
COMMAND		Length	Excavation (cu yds)	Clearing	tenance Construction (Lin ft)	Fill (cu yds)	Labor (Man days)
AAF/MTO &*	671,601	31,685	5,933	309,650	35,270	109	16,149
5th Army	107,379	0	0	0	17,423	0	5,336
PBS*	2,363,085	260,288	459,082	5,490,145	943	1,563	65,719
Rome Area, MTOUSA	34,186	2,050	0	0	47,945	0	3,310
TOTAL	3,176,251	294,023	465,015	5,799,805	101,581	1,672	90,514

*Includes civilian contract work,

4) Airplane malaria control-

a) Operation - Airplane application of larvicides during the 1945 season again became the responsibility of MATS (Mediterranean Air Transport Service) through one of its organizations, the 327th Ferrying Squadron. Although MATS was responsible for supplying both personnel and equipment, responsibility for coordinating the entire program was vested in the Malariologist, MTOUSA, who had authority to communicate directly with both MATS and interested British parties. Early in the year the Malariologist, MTOUSA, requested that the following planes be made available: Ten (10) A-20 Boston's (6 oilers and 4 dusters), three (3) PT-17 Stearman's (dusters) and two (2) L-5 observation planes. In addition, the necessary flying and ground personnel were requested, the general areas of operation outlined and an estimate made of anticipated weekly flying time and required larvicide. Inasmuch as operations were to be carried out almost entirely in northern Italy, bases were established on the west coast at Rosignano Airfield (south of Leghorn) and on the east coast at Rimini Airfield. Later because of changing conditions, it became necessary to move the western base to Pisa Airfield and the eastern base to Cattolica Airfield and still later to Villafranca Airfield near Verona. In each locality, the Commanding Officer of a malaria control unit was made responsible for coordinating airplane larviciding with ground activities: all requests were handled by them and forwarded to the Malariologist. MTOUSA along with reports of work accomplishments. Inasmuch as the program





Airplane dusting with Paris green



A-20's dusting a marshy area near Pisa.



PT-17 dusting overgrown canal near Leghorn.





A-20 oiling canal near Pisa.



Another view of A-20 oiling canal near Pisa.



RESESTATION

on the east coast was largely a British affair, the Commanding Officer of the 10th Malaria Field Laboratory (British) designated the areas to be treated, forwarding the information to the American malaria control unit which in turn notified the pilots as well as the Malariologist, MTOUSA.

b) <u>Personnel and equipment</u> The following is a breakdown of personnel and equipment in the two areas of operation.

EASTERN ITALY

Personnel

Capt. G. C. Dunfield, A.C. lst Lt. C. G. Irwin, A.C. lst Lt. R. A. Uribe, A.C. Ground crew - 10 members

Equipment

5 A-20's

2 - dusters

3 - oilers

1 PT-17 (duster)

1 L-5 (observation)

1 1/4-ton truck

1 1/4-ton trailer

WESTERN ITALY

Personnel

Capt. R. E. Gordon, A.C. 1st Lt. G. H. Sackey, A.C. 1st Lt. R. W. Priest, A.C. Ground crew - 8 members

Equipment

5 A-20's
2 - dusters
3 - oilers
1 PT-17 (duster, later oiler)
1 L-5 (observation)
1 1/4-ton truck
1 1/4-ton trailer

Two additional pilots, Capt. J. H. Rowsey, A.C., and lst Lt. H. V. Jacobsen, A.C., participated in larviciding flights for short periods of time. The remaining Stearman duster was kept at Capodichino Airfield until August, when it replaced the one on the east coast which was destroyed during a heavy hail storm.

c) Preparation and loading of larvicide On the west coast this was the responsibility of the 134th Malaria Control Det. and later the 665lst M.C.D. (Prov). Larvicides were prepared in the Solvay plant at Rosignano, about a mile from the airfield. A 25% Paris green mixture, using diatomacious earth, was mixed in a revolving drum, formerly used for manufacturing chloride of lime. Plant capacity was 5-15 tons a day. DDT solution (5% in diesel oil or kerosene) was prepared in one of the several large stills formerly used for making trichlorethylene. These stills had a capacity of 1,200 gallons; inside, each was equipped with a set of large agitator paddles, which rotated at the rate of 60 RPM. Oil was pumped in from above through pipes connected

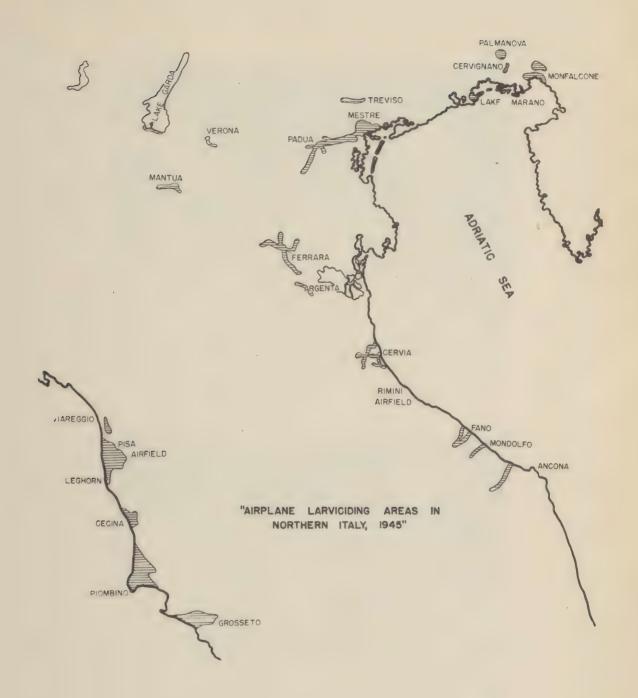
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to a large storage tank outside the building. DDT powder concentrate, in the proper amount was added through a hatchway in the top of the still. Following thorough mixing, the solution was drawn off through a tap at the bottom of the still directly into 50 gallon drums. This still had a capacity output of 2,400 gallons per day. Because of the ease of production, the 134th M.C.D. undertook to prepare large quantities of 5% DDT in kerosene for the PBS Quartermaster for distribution to units. A summary of monthly production figures of this plant is as follows:

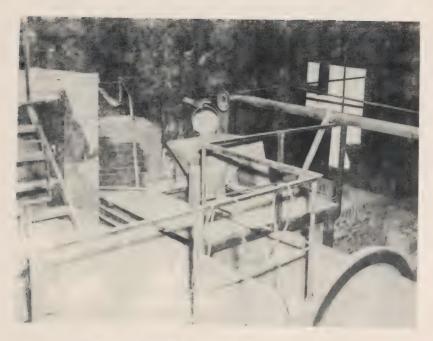
Month	Paris green mix	5% DDT in diesel oil	· · · · · · · · · · · · · · · · · · ·
	(mix)	(gals)	sene (gals)
April	30,756	20,000	· · · O
May	72,700	23,996	14,770
June	82,395	32,970	0
July	45,327	36,300	7,700
August	14,287	22,300	36,300
September	0	0	9,700
Total	245,465	135,566	68,470

Loading of the planes with larvicide took place at Rosignano Airfield; later when it became necessary to base the planes at Pisa, loading operations continued to be carried on at the former field. Italian military labor was used in this work. On the east coast, the larvicides were furnished and prepared by the British. Paris green mix was prepared under civilian contract at Cesena, packed in 60 pound bags and trucked to Rimini Airfield, a distance of about twenty five miles. The diluent used by the British was cement. At the start of operations a 25% mix was prepared, but later the ratio was dropped to 1:6 when it was learned that the heavy cement was carrying unduly large concentrations of Paris green straight down to the water surface. The DDT plant was located right on the Rimini Airfield. Preparation of the 5% oil solution was accomplished by diluting 20% DDT in oleic acid and cyclohexane with HD-50, a heavy motorcycle oil. The prepared solution was stored in three 3,000 gallon tanks from which the planes could be loaded by means of a small gasoline driven pump.

d) Accomplishments- In all, 91,108 pounds of pure Paris green and 33,509 pounds of pure DDT were dispersed by planes from April through the middle of September, at which time unfavorable weather conditions forced a cessation of activities. Of these amounts, 52,880 pounds of Paris green (or 58% of total) and 17,091 pounds of DDT (51%) were applied to eastern Italy and 38,228 pounds of Paris green (42%) and 16,418 pounds of DDT (49%) in western Italy; a small amount of Paris green dusting, 7,875 pounds was done at Elmas Field, Cagliari, Sardinia. Reference is made to Graph V and Wap 1 for airplane activities in Italy. This required 2,048 hours of flying time which analyze as follows: for oiling, 522 hours (27% of total); for dusting, 410 hours, (20%); for test flight, 63 hours (3%); for reconnaissance, 200 hours (10%); for observation, 174 hours (8%); for transport of planes, parts and personnel, 584 hours (29%); for transition flying (training) 62 hours (3%). Larviciding areas on the east coast, which were almost entirely in 8th Army territory, were as follows:







Adding Paris green to mixing tumbler.



Bagging final product (25% Paris green in diatomecious earth).



P.B.S. Insecticide Mixing Plant - - - Rosignano Solvay

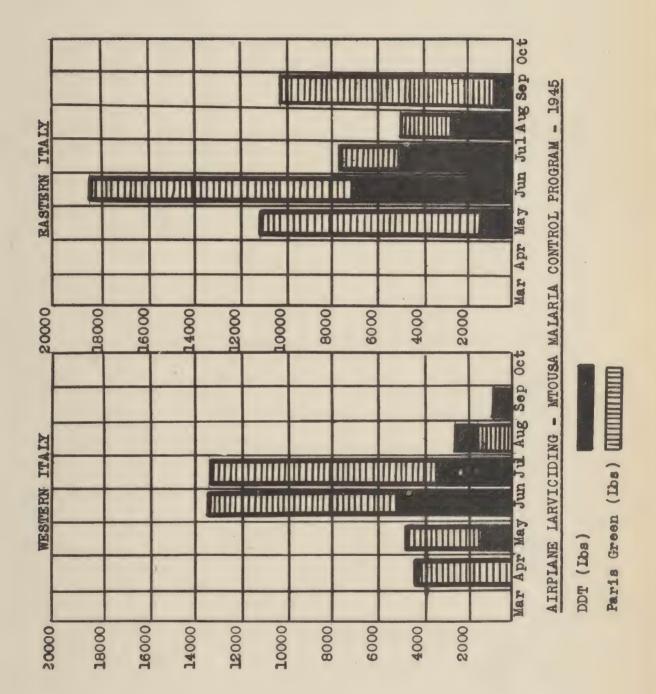


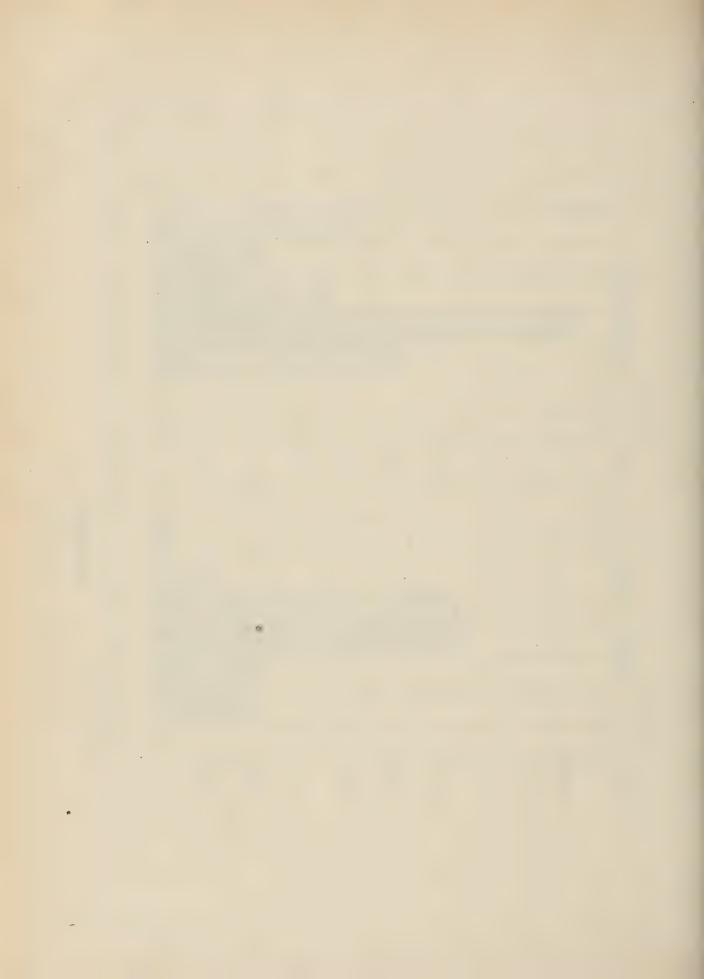
View of top of DDT mixing still, showing oil-inlet pipe, motor, and hatchway (below officer's foot) for adding DDT powder (100%).



Filling 50 gallon drum with 5% DDT in kerosene (or diesel oil), drawn from mixing still shown in upper left hand corner.







Palmanova (British)
Cervignano (British)
Monfalcone (British)
Lake Marano (British)
Treviso (British)
Mestre (British)
Padua (British)
Ferrara (British)
Argenta (British)

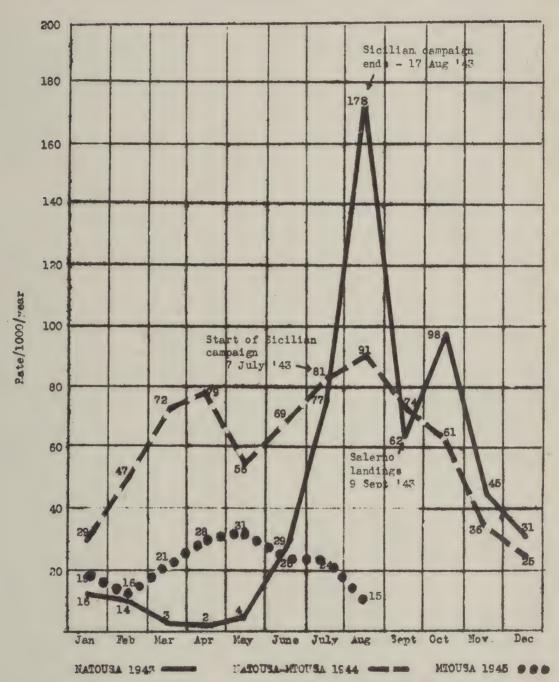
Fano (American)
Mondolfo (American)
Ancona (American)
Lake Garda (American)
Verona (American)
Mantua (American)
Cervia (American & British)

Larvidicing areas on the west coast were as follows: Grosseto, Piombino, Cecina, Rosignano, Leghorn-Pisa areas and the Lake Massiciuccoli area near Viareggio, also at Elmas Field, Sardinia. Because troop concentrations remained relatively static in many of these areas, plane larviciding was in general a continuous thing. Several places in the 8th Army Sector of the Po Valley were presumptive "hot" spots shortly after the spring offensive, but were later abandoned when the troops moved out.

e) Observations— The 1945 airplane malaria control program, which had its origin during the 1944 season, reemphasized the feasibility of utilizing fast planes in the large scale application of dusts and sprays. Early in the season when it was necessary to control anopheline breeding in extensive canal systems which were heavily mined, airplane larviciding proved invaluable. Likewise, the oiling of lengthy canals along the troop jammed highways of the Po delta area shortly after the German capitulation undoubtedly contributed considerably to decreasing the incidence of malaria infection in an otherwise unprotected population. With regard to the working efficiency of the planes from the standpoint of larvicide application, reference is made to a later section of this report dealing with a special study of the oiling planes. In the case of the A-20 dusting planes certain observations made during the summer can be discussed at this point.

(1) A-20 duster- Several tests were run to determine the rate of Paris green application throughout the width of the dust swath when the hopper was full and when it was one third full. Diatomacious earth was the diluent. The results showed that when the plane flew up wind (velocity of wind 5mph) at an elevation of about 20 - 30 feet, the particle deposit of Paris green 70 feet distant from the line of flight was about one third less than directly under the plane. Likewise, when the hopper was one third full, not only was the above ratio maintained but the amount of deposit directly beneath the plane was one third that obtained with a full hopper, indicating a great unevenness of dust flow. Although a 300 feet swath was easily obtained, the rate of deposition throughout was very uneven, varying from 63 particles per square inch to 6,438 particles per square inch. Inasmuch as the dusters were not used to the extent that the oilers were, no attempt was made to try and improve the dust discharge mechanism. Rather, it was felt more profitable to spend the time trying to improve the quality of the oiling planes.

- 5. Summary of Theater malaria experience- The total monthly malaria rates per thousand population per annum for the Theater during 1945 are shown in Graph VI. For purposes of comparison, there have been superimposed on the same base line, graphs depicting the malaria experience during the previous two years that NATOUSA-MTOUSA has been in existence.
- Comparison of three year's experience (1943-1945)-The three graphs portray, with minor aberrations, definite, well defined trends in a series of exceptionally interesting malaria experiences. The first season depicts a completely susceptible and inadequately prepared population exposed to a very severe malaria experience. In the second year, the bimodal curve suggests two things. First, the results of heavy exposure the previous season are manifested in the sharp rise in cases, and second, although occupying a greatly enlarged malarious area under similarly difficult conditions, a more efficient program of malaria control as well as individual discipline has been achieved which is reflected in a greatly reduced disease incidence. By the third year, the spring rise has been markedly reduced (each year this drop has been about double the previous season's summer and fall maximum) and the population has firmly established itself in its new surroundings and improved its control techniques to the point where the disease has almost reduced itself to a minimum. A part of this reduction in 1945 must be attributed to troops moving into more healthy areas; however, many remained in highly malarious areas, yet they have experienced no undue amount of the disease.
- The 1943 Experience- At the outset, in 1943, we are confronted with a presumably susceptible population which obviously had little previous contact with malaria and was apparently incompletely protected. During the winter and spring months little malaria was experienced; a total of only 738 cases were reported between 1 January and 31 May. With the advent of warm weather in June, the new season's primary malarian infections commenced making their appearance. Troops at this time were stationed throughout North Africa from Morocco to Tunisia. At the start of the Sicilian campaign, 7 July, hospital admissions were already on the increase. Many troops slated to participate in the campaign, failed to embark because of malaria. Others reached Sicily but immediately came down with the disease, an incubation period too short to permit contraction of the infection on the island. Obviously poor malaria discipline and inadequate precautionary measures in North Africa were responsible for these early cases. The malaria rate reached a peak in August of 176 per 1000 annum, which represents almost 7,000 cases. This situation coincides with the end of the Sicilian campaign on the 17th of August. With the temporary cessation of hostilities, troops undoubtedly devoted a little more time to malaria discipline, and the consumption of atabrine probably became more regular. We thus find a drop in the rate in September to 62 per 1000 per annum. The abortive rise in the rate to 98 in October is a reflection of the Salerno landings on the 9th of September, atabrine suppressive medication again fell off in the heat of battle and . mosquito transmission was still being effected. With the coming of cold weather, the rates dropped off rapidly. In contrast to the 738 cases



Graph VI. Total monthly malaria admission rates/1000/year in NATOUSA and MTOUSA during 1943, 1944 and 1945 (86ab reports).

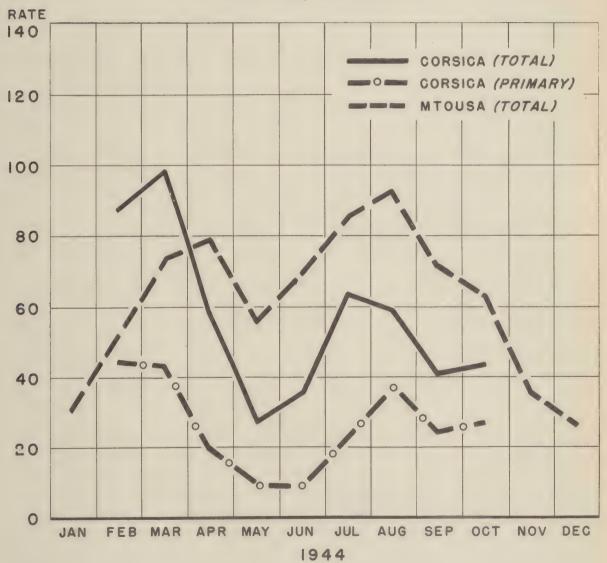


GRAPH WII

MONTHLY MALARIA ADMISSION RATES

IN AMERICAN MILITARY PERSONNEL ON CORSICA DURING 1944

RATE PER 1,000 PER YEAR





reported during the first five months of the year, the following seven months saw over 22,000 hospital admissions. As will be pointed out in the next paragraph, many more infections were obviously contracted, but they remained dermant during the winter months. By the year's end 22,989 cases were officially recorded, giving an annual rate per thousand of 54. It is not known how many of these cases were primary infections, but othershave suggested that 90 percent or more were new. If one considers the primary infections reported during the winter and spring months of 1944 as having been contracted during the previous fall, the transmission levels in 1943 were much higher than the rates suggest.

2) The 1944 Experience- By 1944, troops were well established on the Italian mainland. Cassino fell on the 18th of May; the breakthrough at Anzio on the 25th of May permitted troops to push north through the flooded Pontine marshes and Rome was entered on the 4th of June. The advance northward continued through the highly malarious coastal lowlands, passing through Civitavecchia, Tarquinia, Orbetello, Grosseto and Piombino. Pisa was captured on the 2nd of September and with the advent of winter, troops were well established in the mountains north of Pisa and Florence. Throughout this period, additional American forces (largely Air Corps) were occupying the highly malarious islands of Sardinia and Corsica. The graph depicts a sharp rise in spring cases which reached a peak in April with a rate of 79 per 1000 annum. While many of these cases were recurrences of infections contracted the previous year, a large proportion (approximately 40 percent) gave a history of no previous malaria experience. A few cases were undoubtedly contracted during the spring months, but the majority of these primary infections represent latent malarias with long incubation periods typical of many strains of vivax. This interesting situation of a high primary rate early in the year is clearly depicted in Graph VII showing the malaria experience on the island of Corsica. The spring experience, it is felt, is typical of what occurred throughout the theater; roughly half the reported cases were initial infections. Interviews with these Corsican convalescents revealed contact with a severe malaria situation the previous summer and fall largely in Tunisia. During the first five months of 1944 there were 15.349 cases of malaria reported in the theater. Following the drop in May, the rates started climbing again with the advent of warmer weather and the new season's brood of mosquitoes. Conforming with typical malaria patterns, a peak was reached in August (91/1000/annum). Despite the fact that troops were occupying highly malarious areas, and many of them under combat conditions, the greatly decreased infection rate over that of the previous year, is a tribute to a vigorous and well planned control program which not only emphasized physical methods but individual precautionary measures as well. During the seven month period (June - December) 25,485 cases were reported. While 40,834 represents the total number of cases recorded for the year, which is equivalent to a rate of 61/1000/annum, most, if not all of the 15,349 cases occurring prior to June are attributable to the 1943 season; in addition, probably a good many of the recurrent infections appearing after June can be referred back to 1943.

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3) The 1945 Experience- The start of 1945 found Army mops esconced in the Appenines north of Florence, preparing for the final offensive into the Po Valley. After the highly satisfactory 1944 season, it was anticipated that there would be a considerable drop in the spring rise of cases. This was amply fulfilled as the months passed. The peak appeared in April, a month later than 1944, when a rate of 31 per thousand per annum was recorded. During this five month preseason period, there were 4,591 hospitalized cases, of which approximately one half of these were primary infections. The spring offensive found Amy troops rapidly pushing through the Po Valley. While it was felt that a slowing up of the offensive might provoke a serious malaria situation, particularly around the rice growing sections of the valley, the quick cessation of hostilities (2 May 45) permitted Army to establish the bulk of its troops in the southern Alps, the remainder occupying isolated areas throughout the Po Valley. Elsewhere in Italy, U. S. Military personnel were more or less localized in five general areas, namely; Foggia Plain and Beri area (also a few Air Corps troops at Lecce in the "Heel"), Naples, Rome, Amo Valley from Leghorn to Florence (also small numbers at Cecina and Grosseto), and the Ancona-Rimini sector. Of these areas, Foggia Plain (largely occupied by Air Force) was by far the most dangerous malaria region; elsewhere, malaria was a potentially serious problem, with the possible exception of the upper Arno Valley and the southern portion of the Ancona-Rimini sector. At the start of the transmission season in June, it was expected that there could be some rise in the number of cases; on the contrary, however, there has been a steady drop in the incidence of the disease which, in the light of existing conditions, is quite phenomenal. True, with the capitulation of the German armies in Europe, redeployment of troops to the United States and to the Far Eastern theaters was quickly initiated. However, while this movement was going on military personnel have continued to occupy their former areas. Since June, approximately one half the theater strength comprised Air Force and service troops, who, in general, were established in the malarious areas. As the Army Divisions were redeployed, they too were required to occupy some of these same areas while staging. It is felt that the effective work accomplished by the special War Department Malaria Control Units in addition to the widespread use of DDT as a house spray, played a significant role in keeping malaria to a minimum. During the three month period, June - August, 2022 cases were reported. From January 1945 through August there was a total of 6601 cases reported by the theater, giving a rate of 22/1000/year.

4) F.U.O. In the past, attempts have been made to allocate a certain percentage of fevers of unknown origin to malaria. In this report, this has been deemed impractical, for the following reason. The cases and corresponding rates assigned to FUO are based on hospital admissions. Many of these, and last year 40% was the figure estimated, later receive a diagnosis of malaria and are so reported. Hence, assigning 40% of the present total of FUO's over to malaria would merely be

TABLE VÍI

Monthly F.U.O. experience in NATOUSA-MTOUSA during 1943, 1944 and 1945

	1943		1 9	4 4	1945	
MONTH	CASES	RATE	CASES	RATE	CASES	RATE
January	97	7	2448	51	1533	39
February	100	5	1585	33	1697	43
March	122	5	3596	58	1949	41
April	280	9 8	3234	61	1649	43
May	415	15	2780	52	1374	38
June	1391	42	5364	80	1925	50
July	3837	84	7099	133	1537	57
August	7301	185	6557	122	1477	58
September	5611	132	6411	97		
October	6159	139	3557	66		
November	2944	66	2794	46		
December	3135	54	1826	38	numerocat. An outcomession consultation-whose destructs believe	on Swetzen-dip a apparature calant dipercentrateria en
TOTAL	31392	73	47251	70		on Annual Padd Tableman C. Spillings of C. In

duplicating what has already taken place. Rather, it would seem more logical to deduct 40% from the total FUO's, and then estimate that a certain percent of the remaining FUO's are probably malaria. Meanwhile although signifying little if anything, the monthly cases of FUO admitted to hospitals and corresponding rates for the three year period (1943-1945) are reported in Table VII.

5) Resumé - In summarizing a malaria experience such as has just been described, unless careful, one can wander far into the realms of the theoretical. It is not the intent of this report to ascertain the exact amount of malaria transmitted each year, however the following statistics are set forth in an attempt to show to what degree transmission might have taken place. It has been calculated that 26,820 cases of primary malaria (rate of 54/1000/annum) can be attributed to the 1943 season; this is based on 90% (20,680) of total infections

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TABLE VIII

Monthly overall malaria experience in NATOUSA-MTOUSA during 1943, 1944 and 1945 (86ab)

FILE LATER CANADA SERVICE CONTRACTOR CONTRAC	1. 9 4 3		1944		1945	
MONTH	CASES	RATE	CASES	RATE	CASES	RATE
January	· 234	16	1392	29	759	19
February	270	14	2214	47	636	16
March	64	3	4498	72	988	21
April	59	2	4223	79	.1072	28
May	111	4	3022	56	1136	31
June	952	29	4691	69	1002	26
July	3532	77	4341	81	639	24
August	6925	176	4897	91	387	15
September	2654	62	4870	74		
October	4354	98	3270	61		
November	2006	45	2181	36	The state of the s	
December	1828	31	1235	25	Condition desirated from the reservance of the ACC Three Conditions of the ACC Three C	
TOTAL AVERAGE	22989	COLORO ALBERTA ENGLA PRESENTA ON OPERAL N. J. J. J. J. TOPO ALBERTA ALBERTA COLORO ON OPERAL N. J. J. J. J. TOPO ALBERTA ALBER	CONTRACTOR OF THE PARTY OF THE	61	CHIEF OF CHIEF HOME CARDING TO CHIEF CARD	PRICE STORY STATE

(22,989) hospitalized during the year plus 40% (6,140) of total infections (15,349) reported for the five month period January through May 1944. By the same token there were 18,666 cases of primary malaria (rate of 32/1000/annum) ascribable to the 1944 season: this calculation is based on 16,530 primary infections reported from June through December 1944 plus 2,136 primary infections reported from January through May 1945, all of which were taken from the supplementary, 86ab report. Judging from the small amount of malaria experienced in 1945, it would not be at all surprising if the primary infection rate this past season were well below 10/1000/annum. The theater's three years' experience is summarized in Tables VIII and IX, which record monthly cases and rates as well as primary infections and corresponding rates.

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TABLE IX

Monthly primary malaria experience in NATOUSA-MTOUSA during 1944 and 1945.

1944 ₁ (a)			1945	1945 (b)		
MONTH	CASES	RATE	CASES	(a) RATE	CASES	RATE
January	සම රමු දුනු රක	dan cojn dan	272	7	195	. 6
February	Ope CPF the gas		228	. 6	169	5
March	CDS com time com	cast case Gir	425	9	459	11
April	GAR pay dos que		578	15	453	14
May	2062	39	633	17	407	13
June	3257	48	476	12	408	12
July	2900	54	338	13	263	12
August	3467	64	191	8	ලය සුත ස <u>ක</u>	ළත යන
September	3548	54	· · · · · · · · · · · · · · · · · · ·	,	, m to to	
October	2044	38			ças em em	See SEE
November	717	19			සම සහ සහ	con con
December	597	12	:		gio dio die	gin CD
TOTAL	18592	CD OD 4p			CIS (ID) CIS	CES CVS

Note:

(a) Theater calculations based on supplementary 86ab which did not come into use prior to May 1944.

(b) Calculations based on figures from local malariologists for the following commands: Air Force, PBS, ABC and Rome Area, MTOUSA.

through an endemic malarious area, can result in a violent upsurge of malaria cases of epidemic proportions, has been well demonstrated in Italy. This is perhaps, more vividly portrayed to the individual passing through the war-scarred low coastlands, than it is by scanning what meager statistics are available. In addition to the disruption of social and economic conditions, destruction of pumping stations resulted in the extensive flooding of farmland, canals and ditches became overgrown, and screening, through neglect rotted away, leaving the inhabitants of rural areas completely exposed to the nightly hordes of anophelines. Prior

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TABLE X

Malaria morbidity rates/1000/year for Italy*

REGION	1939	1940	1941	1942
Piemonte	1.4	2.0	3.1	15.0
Liguria	1.1	0.6	2.3	3.9
Lombardia	6.8	6.6	8.2	12.3
Venezia Tridentina	2.3	1.7	1.8	13.6
Veneto	69.5	85.5	100.3	143.6
Venezia Giulia e Zara	14.9	16.2	410.6 (?)	17.4
Emilia e Romagna	28.6	32.6	42.5	66.6
Toscana	15.1	10.9	12.7	17.6
Marche	6.6	11.1	10.3	16.9
Umbria	2.8	2.1	3.5	2.6
Lazio	55.9	45.0	41.2	94.5
Abruzzi e Molise	35.9	86.1	75.0	76.0
Campania	48.9	29.7	28.2	43.8
Fuglie	203.3	332.2	243.5	426.5
Lucania	491.5	908.8	580.6	655.0
Calabria	384.5	453.8	352.2	438.8
Sicilia	248.3	346.5	266.1	413.6
Sardegna	1604.1	1267.0	1883.4	.1928.7
TOTALS * Statistics obtained for	126.1	136.5	140.7	177.6

^{*} Statistics obtained from Istituto Superiore di Sanita, Roma.

to the war, malaria was decidedly on the decline in Italy (morbidity rates of about 100/10,000 inhabitants in 1905 and 13/10,000 in 1939), but in the past few years it has been on the increase. Unfortunately, available statistics are very meager and incomplete, but they do show what has been happening in this country. Table X gives the malaria incidence in the different

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regions from 1939 through 1942. The malaria experience in the Veneto area, shown in Table XI, is a good example of what has happened along the low coastal areas (compiled by Istituto Antimalarico Interprovinviale, Padova).

TABLE XI

Malaria cases in the Veneto area (1939 - March 1945)*

YEAR	PRIMARY	RECURRENT	TOTAL	олностинення простинення подходносту.
1939	973	3,696	4,669	
1940	1,472	4,835	6,307	
1941	2,790	4,126	7,096	
1942	6,320	6,752	13,072	
1943	7,621	10,793	18,414	
1944**	7,555	14,005	21,758	
1945***	919	3,094	4,013	Processors (Electronic designation (Electronic designation)

^{*}Includes provinces of: Padova, Pola, Rovigo, Treviso, Trieste, Udine, Venezia, Verona.

**Period from 1 November 1943 to 31 October 1944

The two provinces producing the greatest numbers of cases were Venezia and Rovige. The Veneto area was largely occupied by British 8th Army troops, yet in spite of the recent severe malaria experience of the region, it is understood that they have had a very low malaria rate this season. Another example of a severe malaria experience is to be seen in Table XII, which shows cases and rates (incomplete as they are) reported by commune in Latina (Littoria) province from June through December 1944. All of these towns lay in the path of the advancing armies, which left behind them chaotic conditions resulting in a high degree of anophelism and subsequently malaria. The phenomenal situation of over 19,000 cases in Fondi is particularly noteworthy. With the exception of the Region of Lazio (see Table XIII) and a portion of the Veneto Region (see Table XI), statistics for 1945 are not available. Some work has been done by the Italian Government, but very little in comparison with the magnitude of the problem. Malaria, of epidemic proportions, is in progress at Gassino again this year. In August, the writer visited the Malaria Station in the town and noted that 554 blood smears had been examined between the 3rd and 31st of July and 343 (61%) were positive: Plasmodium falciparum

^{***}Period from 1 November 1944 to 31 March 1945; incomplete reports from Padova, Verona, Trieste and Pola.

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TABLE XII

Malaria in Latina (Littoria) province (June-December 1944)*

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COMMUNE	POPULATION	CASES	RATE/1000/YEAR
Aprilia	5,200	325	62.5
Littoria	25,000	1,004	40.0
Pontinia	6,065	1,871	310.0
Sabaudia	5,000	1,478	297.0
Bassiano	2,025	35	17.1
Campodimele	1,458	58	39.8
Castelforte	10,750	344	32.0
Cisterna	14,463	2,630	181.0
Cori	10,000	17	1.7
Fondi	18,326	19,734	1071.0
Formia	16,710	6,616	394.0
Gaeta	22,882	1,040	45.6
Itri	6,081	68	11.1
Legnola	3,446	1,509	440.0
M. S. Biagio	4,631	2,184	472.0
Minturno	12,356	5,280	426.0
Norma	3,623	51	14.0
Priverno	13,445	1,309	97.8
Proseddi	2,284	12	5.3
Roccagorga	3,135	118	37.9
S. Felice Circeo	4,425	643	145.5
Sermoneta	3,524	311	87.6
Sezze	16,848	494	29.2
Spigno Sat.	2,690	27	10.0
Sonnino	6,601	16	2.4
Terracina	25,000	7,630	306.0
TOTAL	245,968	54,804	223.0

^{*}Statistics obtained from Istituto Superiore di Sanita, Roma.

TABLE XIII

Malaria cases in Lazio (Jan. thru Aug. 145)*

PROVINCE	JAN	FEB	MAR	APR	MAY	JUN	JUL !	AUG	TOTAL	1944
Frosinone	Was rate over	day tay (ND	2	37	2	CR0 - C20			41	?
Latina#	2479	2110	3218	8211	3740	4677	3740	6948	35,123	47,868(Oct)
Rieti	case CRF Case	1	3	10	1	4	13	28	. 60	17(Nov)
Roma	305	454	1026	1220	1696	1504	1475	1666	9.346	8.157(Nov)
Viterbo	1	1	CELL CILIS (Also	37	50	12	35	58	194	231(Nov)
TOTALS	2785	2566	4249	9815	5489	6197	5263	8700	44,764	56,273

*Statistics obtained from Istitute Superiore di Sanita, Roma #Formerly known as Littoria province.

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Inspections and physical operations



Inspection for anopheline larvae in canal near an airfield located somewhere in the Foggia Plain.



German P.O.W.'s occupied with a drainage project near Foggia.



Personal precautionary measures. . . .



Enlisted men's barracks, showing bed nets hung by means of two wires running the length of the room.



A type of mosquito repellent dispensing bottle which was strongly recommended this season. This particular bottle was in use at the AFHQ Bathing Beach Rest Area at Mondragone, north of Naples.

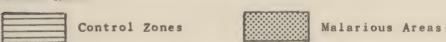




Map 2 - ITALY

(Map - 1:200,000, 1 inch equals 5 kilometers)

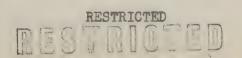
Area of Rome Area, MTOUSA malaria control responsibility around Rome.





accounted for 18% of the infections. During the first three days of August, 34 of 72 examinations were positive (48%) and 26% were falciparum infections. The little village of Céllole (population 3,500) in the Sessa Bonifica at the mouth of the Garigliano River, has had 1,058 reported cases and 20 deaths (due to P. falciparum) from January through August; a survey conducted in Céllole by this Headquarters during the fourth week of August, disclosed a parasite index of 42% and a spleen index of 63%. The fact remains, that in spite of a high current morbidity rate in the Italian population, the disease incidence in American troops has been very slight.

- 6. Malaria control program in the major commands- While the control program as a whole has been adequately summarized in previous sections of this report, it was felt that a brief review of the problem, how it was tackled and the results obtained in the major commands might be of interest.
- a. Rome Area, MTOUSA- This command represented the American section of the Allied Command responsible for the military government in and around the city of Rome. Aside from city workers, principal American troop concentrations were located at Guidonia and Ciampino Airfields (north east and southeast of the city respectively), the 1st Replacement Depot and Headquarters, Replacement Command in the Cecchignola area south of the city, and a few scattered areas north of the Tiber River.
- l) Aside from the city proper, the country around Rome has in the past been considered highly malarious, particularly the low coastal areas at the mouth of the Tiber River (see Map 2). Land reclamation projects (bonification) have improved conditions in these low areas, but there still remain many aquatic situations favorable for anopheline larvae, such as canals and ditches along the coast and small streams meandering through the low hill around the city.
- 2) Throughout Italy, this past malaria season has been hot and dry. In the Rome area, typical of the rest of the country, during the five month period, April August, only 3.39 inches of rain fell. Critical temperatures, favorable to malaria transmission, did not appear until late in May; the average minimum temperature for May was 55.70 F; maximum temperatures were reached in July when a reading of 103° F was recorded.
- 3) Early season inspections in various parts of the southern half of Italy, indicated that the first spring brood of anophelines probably made their appearance during the third and fourth weeks of April. This first brood is not very large and larvae are consequently not seen in abundance until well into June. Although conditions were not propitious for identifying the forms of Anopheles maculipennis collected, it is known that A. labranchiae is commonly found in this area.



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- 4) For lack of personnel, no malariologist was attached to Rome Area, MTCUSA; however, this job was filled by the Commanding Officer of the 133rd Malaria Control Detachment through June, and later by the C.O. of the 6652nd M.C.D. (Prov). During the spring a malaria control school was conducted, with an attendance of 140 men (30 officers and 110 enlisted men).
- M.C.D. from April through June, when it received orders for direct redeployment to the Pacific. Effective 5 July 1945 the 6652nd M.C.D. (Prov) was activated, but it was not until the latter half of the month that an adequate control program was attained; operations were continued through September. Malaria control activities consisted of: mosquito inspections (adult and larvae), physical operations, oil larviciding and house-spraying. Areas receiving attention (see accompanying map) were: Guidonia and Ciampino Airfields, Cecchignola area and the north Rome area. Elsewhere, mosquito inspections and supervisory activities were carried on at Anzlo, Civitavecchia and Tarquinia; at the latter place some DDT house-spraying was accomplished both around the airfield and around a Service Group Headquarters. Reference is made to Graphs I, II, III and IV earlier in this report for summaries of work accomplishment.
- 6) The Allied Commission Malaria Demonstration Unit (Rockefeller Foundation) initiated in March a comprehensive DDT housespraying project in the Tiber Delta area, comparable to that in the Castelvolturno area; approximately 105 square miles of coastland are included in the project. The 133rd M.C.D. cooperated with the Malaria Demonstration Unit, by continuing the house-spraying along the Lido di Roma road up to the walls of the city. This area being contiguous with the Cacchignola controlled area, gave the Replacement Command considerable protection.
- 7) Control operations in the Rome area resulted in an exceedingly low incidence of malaria this past season. Considering Rome Area, MTOUSA, alone, there have been only ten (10) cases of malaria, of which four (4) were primary infections during the five month period, April through August. In the entire area, during the same period, there have been 222 cases, of which 91 were primary infections. Reference is made to Graph VIII showing primary and total malaria rates for Rome Area, MTOUSA superimposed on the theater experience.
- b. Peninsular Base Section- This command, although not spread out to the same extent that it was last year, nevertheless occupied a large amount of territory. Principal areas of occupation were: Naples, Grosseto, Piombino, Cecina, Leghorn and Pisa; following the spring offensive, advance points (largely trucking heads) were set up in the Po Valley at Modena and a few other spots.

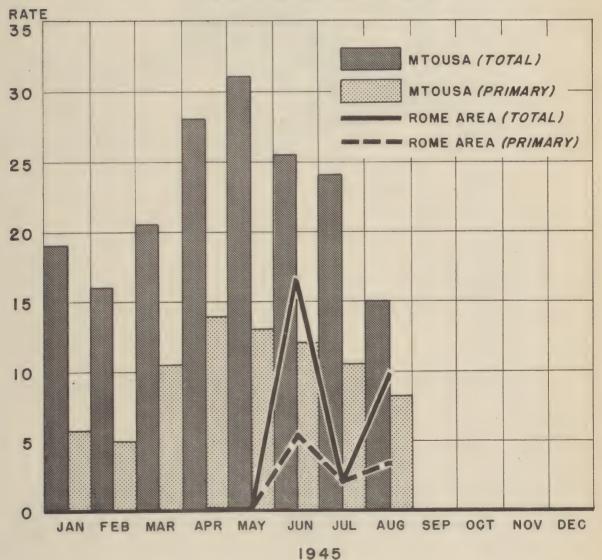
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GRAPH VIII

MONTHLY MALARIA ADMISSION RATES

FOR ROME AREA, MTOUSA DURING 1945 (Malariologist's Reports)

RATE PER 1,000 PER YEAR

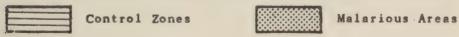


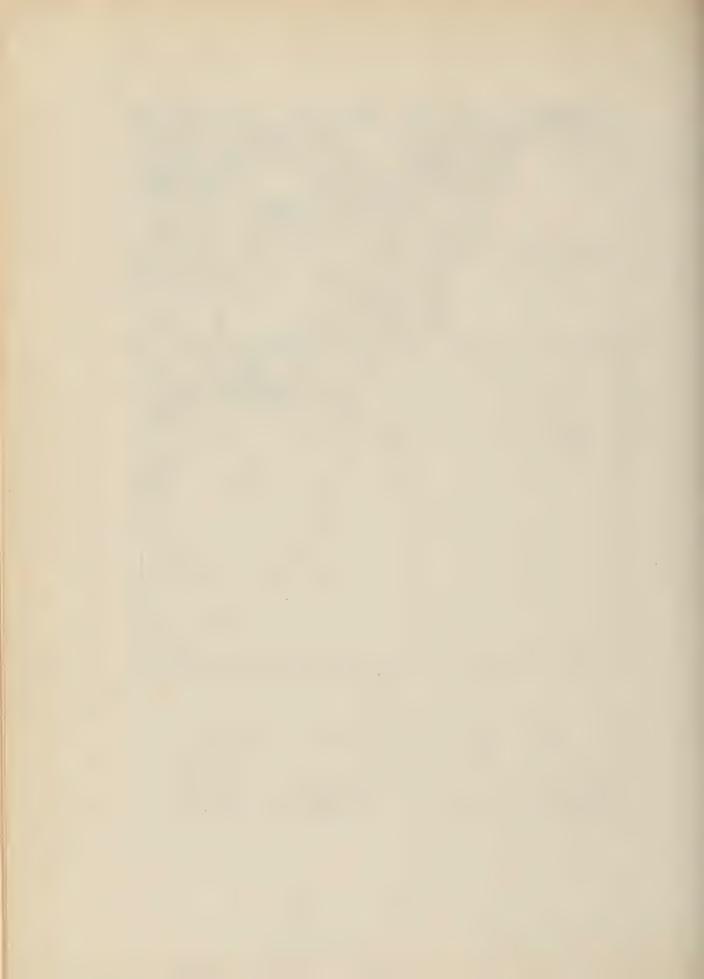




Map 3 - ITALY
(Map - 1:200,000, 1 inch equals 5 kilometers)

Area of PBS malaria control responsibility around Naples





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- 1) Although the degree of malariousness varied considerably throughout the area of occupation (see Map 3 and 4), certain sections, such as around Grosseto and Piombino, were particularly bad. In former years, the Leghorn-Pisa area has not felt much malaria, but with the upsetting of social and economic conditions by the war, there has undoubtedly been an increase in the incidence of the disease in this area. The same situation is true for Naples; however, it is known that the countryside to the north of the city along the Volturno River is highly malarious. The territory occupied by P.B.S., being situated largely along the coast, is characterized by extensive bonification projects, and their associated network of canals and ditches, which unless properly cleaned and larvicided, provide ideal aquatic situations for anopheline larvae.
- 2) Several forms of the maculipennis complex are to be found along the west coast of Italy. Of the more dangerous vectors, Anopheles labranchiae atroparvus is found around Pisa and Leghorn:

 A. labranchiae occurs at Cecina, Piombino, Grosseto and the area north of Naples; and A. sacharovi is restricted to the brackish water areas of the Naples region. Anopheles superpictus appears to occur sporadically throughout the entire area in the hillstreams; at least it is common in the Salerno region and it was found on several occasions near Leghorn this past summer.
- 3) One malariologist was attached to PBS from 2655th M.C.D. (Ovhd) during the period March through August. In addition, there were three malaria control units assigned to the Base Section, namely the 134th M.C.D., 137th M.C.D. and 138th M.C.D., located at Antignano (near Leghorn), Naples and Pisa respectively. With the direct redeployment of the 134th M.C.D. to the Pacific in July, a provisional unit (6651st M.C.D.) was activated 3 July 1945. It was given an expanded T/O of two (2) officers and twenty-five (25) enlisted men, which permitted a detachment of one (1) officer and eleven (11) enlisted men to move to Naples in August and assume the duties of the 137th M.C.D. when that unit ceased activities preparatory to movement.
- 4) Two malaria schools were held during April in Naples and Leghorn, with an attendance of 1340 persons (484 officers and 856 enlisted men).
- 5) EM antimalaria details, as in other commands, attended to bed nets, spraying of quarters and water tidiness in unit areas. They also carried on some oil larviciding in and around their own bivouac sites, but the bulk of this work was done by WD malaria control units.
- 6) A considerable amount of civilian contract canal and ditch cleaning work, amounting to several million lire, was carried on in the Pisa, Leghorn and Naples areas.



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- 7) Malaria control units, although accomplishing a fair amount of oil larviciding and ditching work, concentrated largely on DDT house-spraying projects which resulted in large areas of country-side coming under the influence of DDT. Reference is made to Graphs I, III and IV, previously referred to in this report for summaries of work accomplishment.
- 8) Airplanes, responsible for larviciding in western Italy, largely in Base Section territory, were based at Pisa. Responsibility for mixing larvicide and loading planes was delegated to the 134th M.C.D. (and later the 6651st M.C.D.). Larvicides were mechanically prepared in a large plant at Rosignano Solvay near Cecina; a description of the operation and work accomplishment of this plant has been given in detail earlier in this report.
- 9) PBS malaria experience during 1945 is shown in Graph IX, superimposed on that of the theater. Although the areas where the bulk of PBS troops were located are not highly malarious the low incidence of primary malarias is a reflection of a well organized control program.
- Command Inasmuch as Adriatic Base Command occupied much of the same territory in eastern Italy occupied by the Air Forces, the malaria control program of the two commands will be discussed together. ABC, with headquarters in Bari, acted as the servicing agency for the Air Force units scattered along the Adriatic; aside from Bari, its installations were located at Foggia and Senigallia (Ancona-Rimini sector). Fifteenth Air Force occupied the Foggia area while Twelfth Air Force made up the bulk of Air Corps installations in northern Italy.
- area occupied by American personnel this past season. It is a wide, undulating prairieland through which wander numerous small streams and ditches. Occasional and sometimes rather extensive, seepage outcroppings occur throughout the area. In addition, near Manfredonia, where the Candelaro and other rivers empty into the gulf, there lies an extensive marsh, known as the Manfredonia Swamp. All of these aquatic situations provide ideal larval habitats for Anopheles labranchiae; in the Lake Lecina and Lake Varano areas to the north, Anopheles sacharovi has been reported from brackish water habitats. Scattered throughout the Foggia plain were large airfields bases for the heavy bombardment groups; in addition there were a few fighter fields near Lake Lecina and San Severo (see Map 5).
- 2) Farther north, along the Adriatic coast, another group of airfields existed in the Ancona-Rimini sector (see Map 6). This area has not been considered malarious by the Italians, except for the

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178

northern section which borders on the Po Valley; here one is apt to come in contact with Anopheles sacharovi and A. labranchiae atroparvus. Fortunately, only one American airfield was established in this area (Cesenatico), the remainder being situated between Rimini and Ancona. The land around Cesenatico is very low and flat and is intersected by many canals and ditches; early in the year much of the ground was flooded (the result of both natural and unnatural causes), but the repairing of damaged pumping stations together with the advent of warmer weather caused the countryside to dry. South of Rimini, the coast largely consists of measa-like hills which rise directly back from the shore. The soil is gravelly so that there are no coastal marshes. Practically the only aquatic situations are a few large rivers, which in the summer are reduced to mere trickles of water, containing an abundant growth of algae. These river beds were heavy producers of anopheline larvae. which were probably Anopheles claviger, A. messeae and A. maculipennis.

3) Elsewhere in Italy, the Air Force had troops around Florence, Pisa, Cecina, Grosseto, Tarquinia, Rome and Naples. The malaria picture in these areas has already been discussed in previous sections.

4) One malariologist was attached to AAFSC/MTO from 2655th M.C.D. (Ovhd) during the period December 1944 to October 1945; in April he was further placed on TDY as malariologist with ABC when that command assumed the responsibilities of a Base Section. For two months early in the year, and again for six weeks in August and September, 2655th M.C.D. (Ovhd) placed another officer on TDY with Service Command and ABC to assist the malariologist. Four malaria control units were assigned to ABC for duty in eastern Italy, namely, the 130th M.C.D. (Cattolica), 135th M.C.D. (Cerignola), 136th M.C.D. (Madna-Ramitelli, later San Severo) and the 139th M.C.D. (Foggia). With the direct redeployment of the 135th and 139th M.C.D's in July, the 6653rd M.C.D. (Prov) was activated, effective 23 July 1945. The 6653rd M.C.D. (Prov), with headquarters at Foggia, was given an enlarged T/O of two (2) officers and twenty-five (25) enlisted men, which permitted it to assume the control obligations of the 135th and 139th M.C.D's, and later, those of the 136th M.C.D. as well. A fifth unit (42nd M.C.D.), under the control of the Air Force malariologist, was attached to AAFSC/MTO and operated out of Pisa. It's sphere of responsibility included all Air Corps installations in western Italy, which to all intents and purposes, included Siena, Grosseto, Cecina, Pisa, Pontedera and Florence.

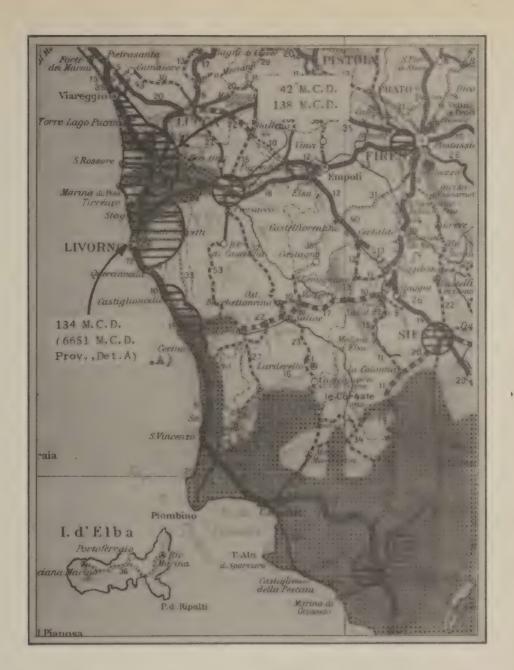
5) Three sets of malaria schools were given to Air Force and ABC personnel during the spring months, with a total attendance of 2,071 persons (944 officers and 1127 enlisted men). The first course was given in January and February to laboratory officers and enlisted technicians. A second course was given in March and April to medical officers and malaria discipline officers and a third course for EM anti-

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malaria details was completed in May. It should be noted that the task of conducting these schools was a tremendous one, as it required continuous travelling throughout Italy with classes being held almost every day. For successfully accomplishing this project, while at the same time trying to organize and initiate a control program, the malariologist deserves a great deal of credit.

- 6) Although the EM antimalaria details undoubtedly did good work in the Foggia area, as well as elsewhere in Italy, it is felt that the great bulk of the control activities in the theater were carried on by the WD malaria control units, and to them goes the credit for a successful malaria season. While the malaria control units working in Air Force areas, did a considerable amount of oil larviciding and a fair amount of ditch cleaning, their greatest effort was devoted to treating houses with DDT. As a result, almost a half of the Foggia plain came under the influence of this insecticide, and large areas were likewise treated in the Ancona-Rimini sector, and around Florence, Pontedera, Pisa, Siena, Grosseto and Cecina. In July, at the time when two of the control units left the Foggia area, there was a period of about three weeks when control activities were decreased to a minimum; during this critical period, when there could have been a serious outbreak of new cases, the incidence of primary malarias did not appreciably rise, and it is felt that this was due to the widespread use of DDT. It might be added, that the malariologist, together with three enlisted men, carried on the control activities during this period until the 6653rd M.C.D. (Prov) could take over the job. Reference is made to Graphs I. II. III and IV in an earlier section of this report for summaries of work accomplishment.
- 7) Extensive stream and ditch cleaning projects under civilian contracts was carried on both in the Foggia and Pisa and Grosseto areas.
- 8) A small amount of airplane larviciding was done around American installations in the Ancona-Rimini sector and at Lake Lecina; the great bulk of this work in eastern Italy was directed against anopheline aquatic habitats around British installations in the T Valley and along the northern Adriatic coast. Planes were based at Cr lica; reports of their activities were handled through the 130th M.
- 9) The malaria experience for Army Air rces, Mediterranean Theater of Operations is shown in Graph X sup mposed on that of the theater. While the rates have tended to surp is those of the theater, they are still not particularly high, when one considers that the Air Forces occupied the most highly malarious areas occupied by any American troops in the theater. The high rate of primary malarias in March followed by a tapering off in subsequent months probably can be directly correlated with the malaria schools. When medical officers



Map 4 - ITALY

(Map - 1:200,000, 1 inch equals 5 kilometers)

Area of PBS, 5th Army and AAFSC/MTO malaria control responsibility in northwestern Italy



Control Zones



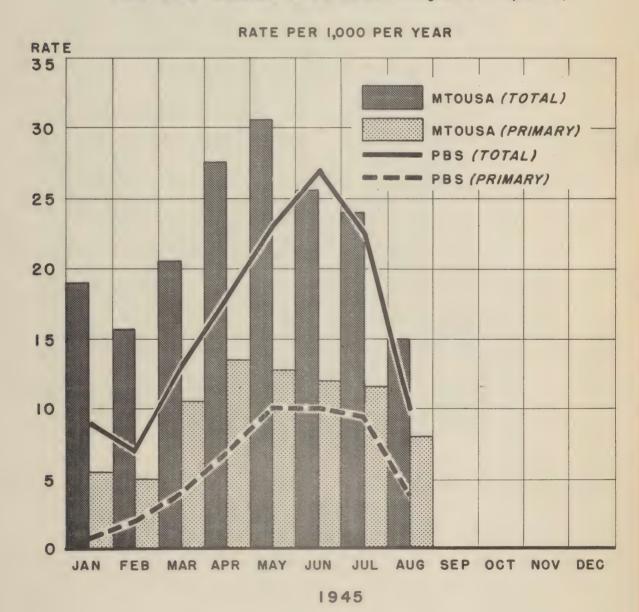
Malarious Areas



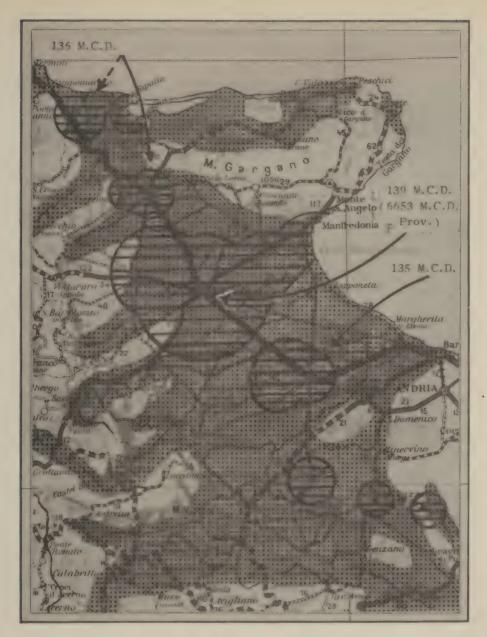
GRAPH IX

MONTHLY MALARIA ADMISSION RATES

FOR PBS DURING 1945 (Malariologist's Reports)







Map 5 - ITALY

(Map - 1:200,000, 1 inch equals 5 kilometers)

Area of AAFSC/MTO and ABC malaria control responsibility southeastern Italy (Foggia)

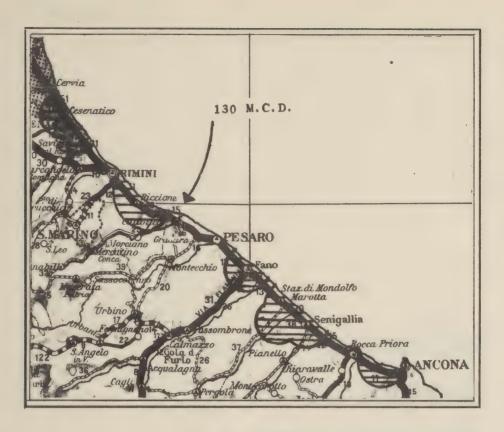


Control Zones



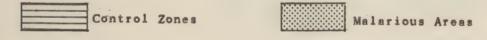
Malarious Areas





Map 6 - ITALY
(Map - 1:200,000, 1 inch equals 5 kilometers)

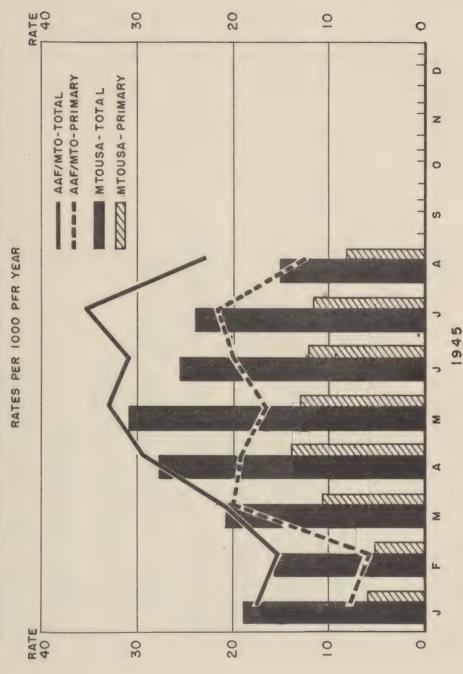
Area of AAFSC/MTO and ABC madaria control responsibility in northern Italy.





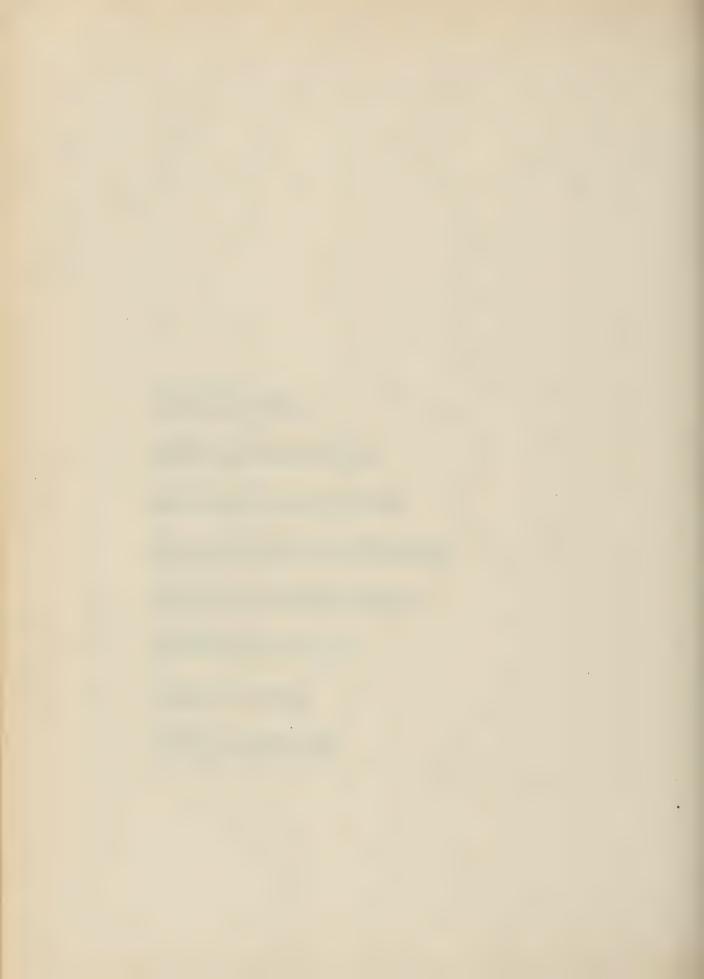
GRAPH X

MONTHLY MALARIA ADMISSION RATES FOR AAF/MTO DURING 1945*



* MALARIOLOGIST'S REPORTS

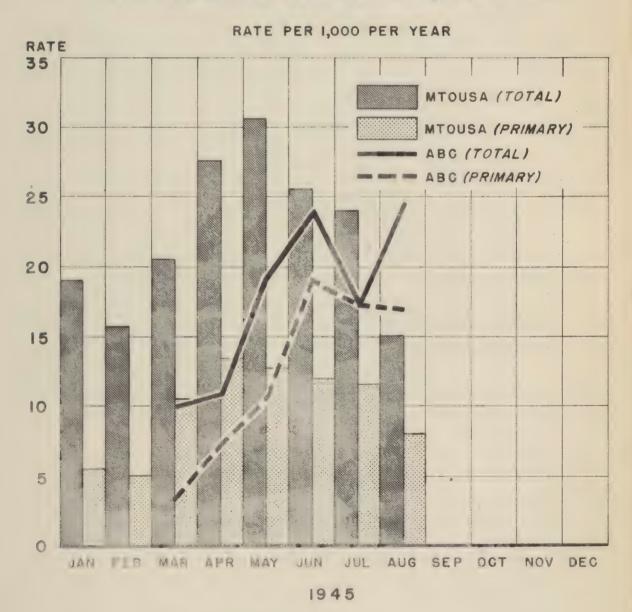
APPENDIX 32R

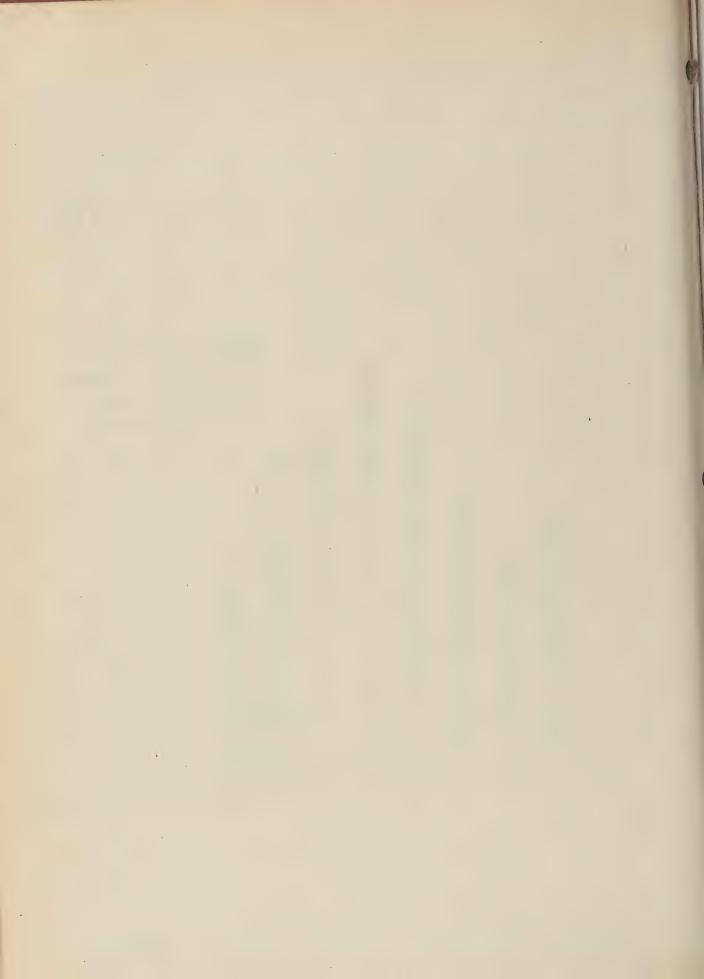


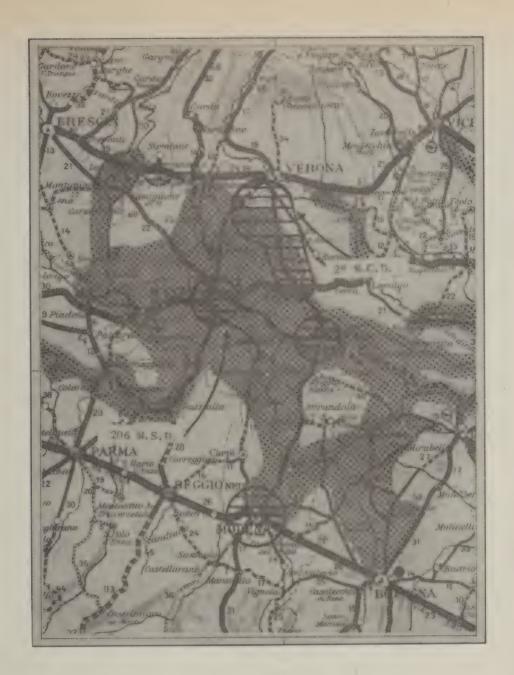
GRAPH XI

MONTHLY MALARIA ADMISSION RATES

FOR ABC DURING 1945 (Malariologist's Reports)







Map 7 - ITALY
(Map - 1:200,000, 1 inch equals 5 kilometers)

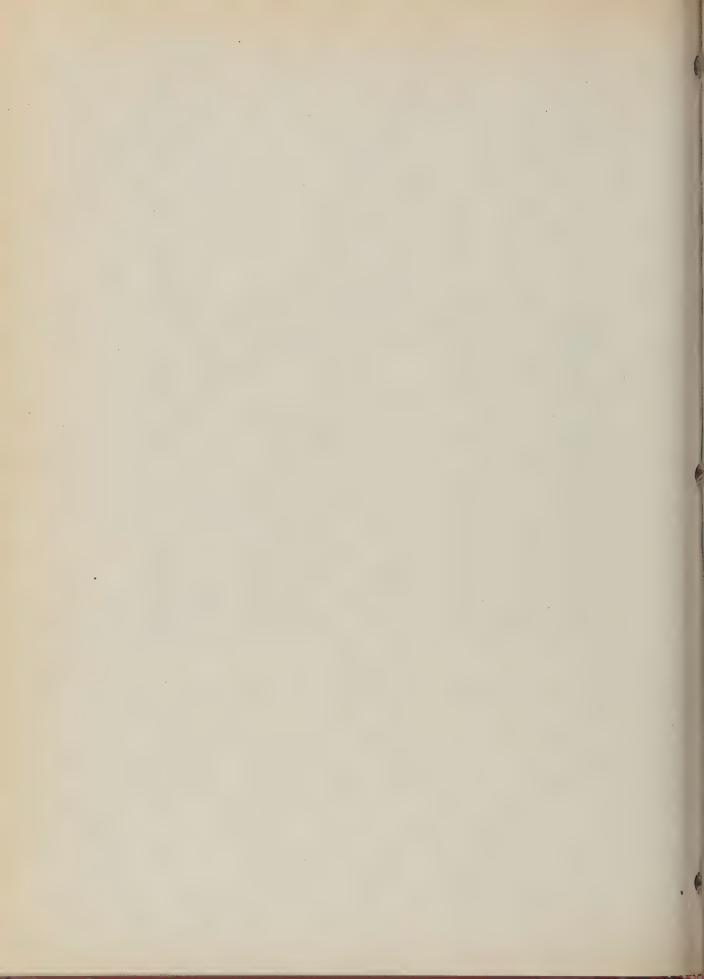
Area of 5th Army malaria control responsibility in Po Valley.



Control Zones

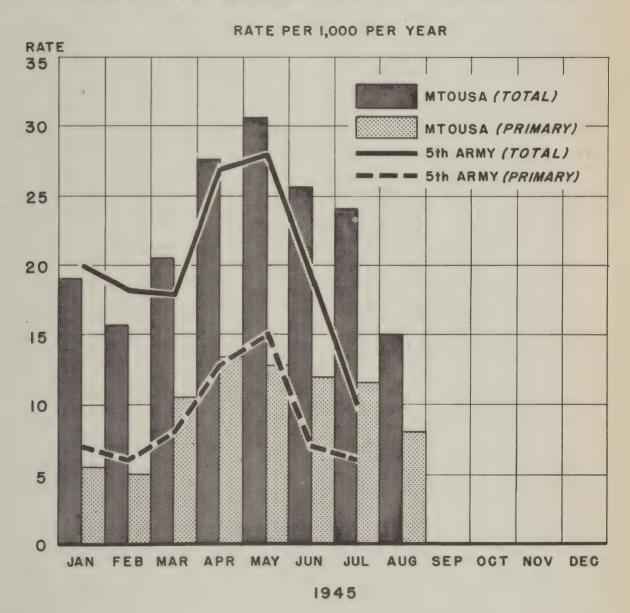


Malarious Areas



GRAPH XII

MONTHLY MALARIA ADMISSION RATES FOR 5th ARMY DURING 1945 (Malariologist's Reports)





RESERVEDTED

in April learned that there couldn't possibly be much transmission going on in the spring because of low temperatures, they decided to call more of their malarias recurrences. If this is true, it shows the fallacy of the present reporting system. Medical officers or their "assistants* either don't get the necessary information from the patient or else they have no interest in doing so. As a result, cases are classified in the 86ab only as malaria, and if there is no subsequent breakdown as recurrent infections, the logical assumption is that they are primary malarias. While the total Air Force rates during the transmission seasons of 1944 and 1945 fairly closely approximate each other. it is felt that the 1945 season has been a much more satisfactory one. The malariologist this year had made a definite attempt to pick up all cases hospitalized by other commands (PBS, ABC and Rome Area, MTOUSA), so that a fairly accurate picture has been obtained. Last year, relatively accurate statistics were available only from the Foggia area (15th Air Force), while elsewhere, many cases (largely 12th Air Force) were lost because they were not assigned back to the proper command; if this had been possible, the total Air Force rates would undoubtedly have been much greater than reported.

10) ABC malaria experience is portrayed in Graph XI, which shows the rates of total and primary malarias superimposed on those of the theater. Most of ABC personnel were stationed in relatively malaria free areas - Bari and Senigallia; however, those located at Foggia were exposed to possible infection. Although the rates tend to indicate an undue amount of malaria, actually this was not the case, the illusion being created by the small strength of the command.

d. Fifth Army- During the winter many of Army's troops were entrenched in the Appenines north of Florence and Pisa, the remainder being bivouaced along the Arno Valley. Following the spring offensive, with its wild dash across the Po Valley, ending in the German capitulation on the 2nd of May, Army troops (Divisions) largely established themselves in the malaria free Alps from the French border east to the countryside near Gorizia. The relatively few remaining troops took up locations on the Valley floor, generally in the area around Verona and south to Modena, the latter being a truck head for supplies coming from PBS. A great deal of rice is grown around Mantua, and this together with the general abundance of water everywhere accounts for the reason why a considerable amount of malaria exists in this region (see Map 7). It would appear from the existing literature that Anopheles labranchiae atroparvus is the principal vector in the central Fo Valley, but a number of other anopheline species (all potential vectors from the military standpoint) exist in the area.

RESTRICTED RESTRICTED

- I) No malariclogist was attached to Army from 2655 M.C.D. (Ovhd), this year, the position being held by one of its own Sanitary Corps officers (the same as in 1944). Assigned to Army were two malaria units, the 28th M.C.D. (Florence, later Butapietra near Verona) and the 206th M.S.D. (Viareggio, later Mantua). During March and April, the 206th M.S.D. worked around Viareggio. In May, it moved to Mantua, where it carried on control activities for one month and then received orders for indirect redeployment. The 28th M.C.D. transferred its activities from the Florence area to Butapietra (near Verona) in May and continued operating in the same general region until 15 July when it moved back to PBS pending orders for indirect redeployment. Activities of both these units, although unfortunately cut short by redeployment orders, were largely concerned with house-spraying; some ditching and larviciding work was accomplished, but on a relatively minor scale. See Graphs I, II, III and IV in an earlier section of this report.
- 2) While the taking of atabrine was not generally made compulsory in 1945, Army did designate certain atabrine areas in the Po Valley where the daily consumption of one tablet was mandatory. Atabrine areas were as follows: a few localities around Milan, and a section of the Valley from Mantua east to the Adriatic, bounded by the Po River on the south and on the north by a line running just south of Verona east to Padua and thence north along the coast bordering on the Gulf of Venice.
- 3) Airplane larviciding, by planes based at Rimini, carried on weekly operations in three Army areas, namely: the southern shore of Lake Garda, a small area near Verona, and the upper and lower lakes at Mantua, formed by the Mincio River.
- 4) Malaria schools were conducted during March and April; total attendance was 2,597 persons (888 officers and 1691 enlisted men).
- 5) Army malaria experience superimposed on that of the theater is portrayed in Graph XII. While closely approximating theater rates through May, the sharp drop in June and July would appear to be the reflection of the salubrious bivouac areas which the majority of Army troops occupied.
- 7. Research- Several problems of a research nature have been investigated this past season. Reports of two of these studies are to be found at the end of this report, namely:
- a. "A study of winter DDT house-spraying and its concomitant effect on anophelines and malaria in an endemic area" Thomas H. G. Aitken, Major, Sn.C.
- b. "Oil spraying equipment for the A-20 (Douglas) and PT-17 (Stearman) airplanes" William J. Wyatt, Major, Sn.C.

IN E & RESCHIER I E U

8. Conclusions.

a. Despite the fact that American forces have spent another year in Italy, occupying many areas which were highly malarious, and amazingly low malaria rate has been experienced. Total diagnosed cases during the first 8 months of 1945 were 6601, giving a total annual rate per thousand of 22. During the three year period that NATOUSA-MTOUSA has been in existence, malaria incidence has steadily declined from the high levels reached during 1943 (reflecting North Africa, Sicilian and Salerno experiences). Total malaria cases and rates (theater calculations) for the three year period are as follows:

YEAR	TOTAL	MALARIA RATES
1943	22,989	54
1944	40,834	61
1945*	6,601	22

*First 8 months.

One can perhaps obtain a clearer impression of the three year theater experience, if one considers that the high incidence of spring primary infections is largely the result of transmission the previous fall. With this in mind, it has been calculated that there were 26,820 cases of primary malaria in 1943 giving a rate of 54/1000/annum. In 1944 there were 18,666 primary infections - a rate of 32/1000/annum. Judging from the small amount of malaria reported in 1945, it would not be at all surprising if the primary infection rate this past season were well below 10/1000/annum.

- b. This decline in malaria incidence is believed to be due to a variety of factors, which were largely summarized in the 1944 report, and which it is felt still hold true.
- l) The presence of a larger, more highly integrated and coordinated malaria-control organization able to distribute malaria survey and control units where needed, to provide trained malariologists to major commands and to supply airplane-larviciding facilities as required.
- 2) A greater command and line consciousness of malaria and its potentialities for imperiling military success. This is due to the 1943 disease experience and the educational program carried on during the past two years.
- 3) A greater troop understanding of how to prevent malaria by personal measures due to the educational program.

RESTRUCTED

- 4) Adequate supplies of materials, equipment, transport and labor. The special list of excess equipment authorized by MTOUSA in 1945 to malaria control and survey units has been of inestimable value in speeding up control activities. In addition, it is felt that the widespread use of DDT this past year has perhaps contributed more than any other single item to the lowering of the 1945 malaria rate.
- and survey units, flying personnel (airplane larviciding) and EM antimalaria details to wage unrelenting war on all stages of the anopheline mosquito. It is the belief of the writer, that the credit for the great reduction in the disease incidence over 1943 largely goes to the malaria control and survey units and the malariologists who coordinated their activities. That many EM antimalaria details did play an important role is not denied, but in general, there was a lack of interest and the work was shoddy and, as a result, couldn't always be relied upon. Under such conditions, it was better for the control unit to undertake the job and do it thoroughly; fortunately, DDT house-spraying provided a tremendous margin of safety in areas not under close supervision.
- 6) The location, in 1945, of a fair proportion of troops in malaria free or relatively free areas.
- c. As was the case last year, non-effectiveness due to malaria has at no time jeopardized military operations in 1945.

9. Recommendations - None.

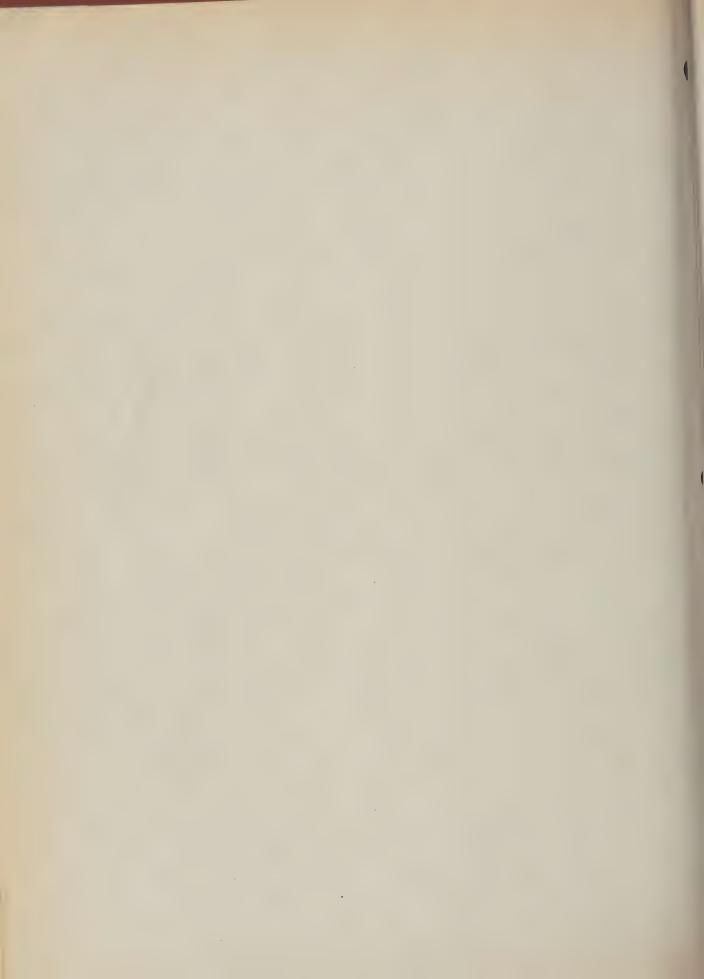
10. Acknowledgements- For their whole-hearted cooperation in making this season's program a success, the writer expresses his deep appreciation to Major-General Morrison C. Stayer, USA, Surgeon, MTOUSA, Colonel William S. Stone, M.C., Preventive Medicine Consultant, MTOUSA, Colonel E. Standlee, M.C., Deputy and later Surgeon, MTOUSA, other members of the Medical Section, Hq. MTOUSA and other commands, and 327th Ferrying Squadron, MATS, who have done all in their power to assist the malaria control project, the members of the Rockefeller Foundation Malaria Demonstration Unit, the Commanding Officers and enlisted personnel of the various malaria control and survey units, and last, but not least, the members, officers and enlisted personnel alike, of 2655th Malaria Control Detachment (Ovhd) who have at all times demonstrated a remarkable spirit of loyalty, ingenuity and industry.

/s/Thomas H. G. Aitken
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A STUDY OF WINTER DDT HOUSE-SPRAYING AND ITS CONCOMMITANT EFFECT ON ANOPHELINES AND MALARIA IN AN ENDEMIC AREA

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5 October 1945



GENERAL

Realizing the potentiality of the lasting qualities of DDT, a number of people have expressed their interest in knowing what effect the elimination of hibernating anopheline females, by winter spraying of all resting places, together with no subsequent larviciding measures, will have on the anopheline population of a given area during the following season. Furthermore, will one complete treatment so reduce the mosquito population, that malaria transmission will cease, or at least be reduced to an insignificant level?

Having discussed these thoughts with Colonel William S. Stone. MC. Chief of Preventive Medicine Section. Office of the Surgeon. MTOUSA, as well as with members of the Rockfeller Foundation Malaria Demonstration Unit, Allied Commission, it was decided to initiate studies in the Bonifica di Castelvolturno, about an hour's drive north of the city of Naples, Italy. In addition to being close to Naples, the Castelvolturno area was chosen because the Malaria Demonstration Unit, A.C., had carried on DDT house-spraying and dusting studies in the bonifica during the 1944 season and had amassed a great deal of important data regarding: (1) the degree of malaria endemicity (parasite and spleen surveys were made in May, August, and October); (2) entomological data concerning the species of anophelines existing in the area; (3) the fluctuation in numbers of adult mosquitoes in treated and untreated shelters (based on weekly inspections); and (4) the longevity effects of single applications of 5% DDT in kerosene (determined by daily liberation of lots of 100 adults in treated ventilated and unventilated rooms and recording the results the day following).

DESCRIPTION OF THE AREA

The Bonifica di Castelvolturno occupies the coastal portion of a wide plain lying at the mouth of the Volturno River (see accompanying map). Whereas the 1944 experimental area only included a portion of the bonifica south of the river approximately six miles long by three miles wide, it was felt, after discussing the matter with Dr. Fred L. Soper (Rockfeller Foundation), that more conclusive results could be obtained if the test area were expanded. It was therefore decided that the enlarged area, which was bounded on the west by the Tyrrhenian Sea, should consist of a coastal strip, approximately five miles wide, extending from the Mondragone hills south to the village of Qualiano, thence following the hills in a southwesterly fashion to Mt. Cuma. Included in this zone of approximately 93 square miles, are two additional bonifiche, namely, the

Bonifica di Vareaturo and the Bonifica di Licola, also the towns of Mondragone (population 15,000?), Castelvolturno (population 1,500?) and Villa Literno (population 5,000?).

The area in general is thickly interspersed with canals and ditches, most of which have seen little maintenance in recent years and as a result are choked with vegetation; some ditch cleaning was accomplished in 1944, but nothing was done in 1945. A few artesian wells also exist in the area. Destruction of one pumping station in the Licola-Varcaturo area and three stations in the Castelbolturno area by the retreating Germans late in September of 1943 caused two marshy lakes to be formed with the resultant flooding of many houses. The lake in the Varcaturo Bonifica which was approximately a half mile wide and three miles long, remained in continuous existence for almost two years; on the 18th of July 1945, the reconstructed pumping station commenced operations and within three weeks the marsh was practically dry. The inundated area in the Castelvolturno Bonifica, which was approximately one and a half miles wide and four and a half miles long, became dry both summers as the result of rehabilitating one of the pumping stations; unfortunately this station did not have the capacity to compete with heavy winter rains, and as a result the reclaimed farmlands were flooded each winter. This past season, the lake had disappeared by the first week in June.

Perhaps the driest part of the experimental area is the southeastern corner, from the shore of lago di Patria east to Qualiano where the land rises slightly, affording good drainage. Throughout this section one finds the old style of Italian farm house, consisting of several floors and many rooms and stables with very high ceilings, all of which tends to make house-spraying very difficult. On the other hand, the bonifica houses are modern and simply constructed; treating these is an easy matter.

During the winter months of 1945, experimental activities were handicapped by cold, rainy weather, bad roads (some impassable) and an abundance of mud. With the coming of summer, the mud turned to deep drifts of dust. A hot, dry season eliminated many aquatic situations; however, the principal irainage canals and many of the smaller ditches contained water and were completely overgrown with algae, duck weed and other vegetation, providing ideal anopheline larval habitats. The following table gives local weather data, which of necessity had to be taken from Capodichino Airfield, Naples. It will be noticed that temperatures tended to be somewhat higher and rainfall slightly less in 1945.

TABLE I
Weather Data for the Naples Area (1944 & 1945)

MONTH	AV MAX	TEMP	AV MI	N TEMP	MEAN	TEMP	HAIN	weather special distributions
January February March April May June July August September October November December	53°F 51 54 69 75 80 85 89 81 70 61 55	1945 49°F 56 61 68 78 85 89 87 79	39°F 39°F 41 52 57 60 65 69 61 53 47	36°F 40 43 50 56 65 67 67 61	46°F 45 48 60 66 70 75 79 71 62 54 49	42°F 48 52 59 67 75 78	The same of the same of the same of	1945 hes 11.37 0.91 0.20 0.54 2.84 Trace 0.20 0.59 5.26

TOTAL

45.92 Inches

THE 1944 SEASON

The following is a brief review of the activities and accomplishments of the Malaria Demonstration, A.C. in the Castelvolturno area during 1944. A complete report has been prepared by that organization and submitted elsewhere.

application of insecticide and its effectiveness - Original applications in May were directed towards determining the relative merits of spraying with 5% DDT in kerosene and dusting with 10% DDT in powder (pyrophylite). Zones B & D received an application of oil, E and F were treated with dust and A and C remained as untreated controls (see map). Because of the rather poor results obtained with powder, houses which had received this treatment were again dusted in July. In August, the entire bonifica of 214 houses (all six zones) were sprayed with 5% DDT in kerosene, all except for two test bedrooms in Zone B, which received only the original spraying.

DDT spray was applied with a hand-operated knapsack sprayer having a Bordeaux nozzle. Walls and celings were treated at the rate of 60 milligrams of DDT concentrate per square foot of sprayed surface, or one quart per 1,000 square feet. In August, when the bonifica was resprayed, 328 pounds of DDT concentrate were required to treat the 214 houses.

Effectiveness of the applications was determined both by the daily liberation of 100 mosquitoes in ventilated (screened windows) and unventilated (glass window closed) bedrooms (previously sprayed) and counting the dead on the following day, and by making weekly catches in survey stations (sprayed and untreated controls).

The August report of the Malaria Demonstration Unit, A.C., records 100% kills in unventilated rooms 105 days after spraying and around 90% kills in ventilated rooms during the same period. The results obtained in unventilated rooms are not particularly significant as similar results were noted in unventilated rooms which had not been sprayed, suggesting that factors of temperature and humidity were involved. It is known that effective control was still being obtained in ventilated rooms in October, approximately five months after spray application.

Effective control of adult mosquitoes entering human habitations and stables (as contrasted with the "100 liberated mosquito technique" results mentioned above) was obtained for at least 80 days after treatment. During a visit to the bonifica on the 13th of December, no mosquitoes could be found in several of the treated houses examined, whereas 51 anophelines were counted in 15 minutes in a nearby untreated house, indicating that hibernating anophelines were present in the area.

Entomological findings (anopheline species) - Anopheline species encountered in the area consisted of: Anopheles labranchiae, A. Sacharovi, A. melanoon and A. messeae. Whereas A. labranchiae was the dominant species early in the year, August surveys indicated that A. sacharovi accounted for 80% of the captured anophelines.

Degree of malaria endemicity - Of considerable importance to the 1945 project, were the three speen and parasite surveys conducted during May, August and October of the previous season. Only bonifica children between the ages of 5 and 15 years were examined; fortunately, it was possible to utilize the services of the same doctors in these as well as subsequent surveys, thus enhancing the value of the spleen palpations.

The May survey was initiated prior to the house spraying, so we have here a true picture of the malaria endemicity of the area (see Tables VI and VII). It is of interest to note the very rapid drop in the parasite index from 21% to 8% during the three and a half month period following the application of DDT.

THE 1945 SEASON

House-spraying activities - Using the 100% DDT concentrate, preparation of a 5% mixture in kerosene was initiated by the 137th Malaria Control Detachment in Naples late in December 1944. Mixing was accomplished by rolling 50 gallon oil drums back and forth during the hottest part of the day; that a good mix was obtained is evidenced by the fact that at no time was a DDT sludge found at the bottom of the drums.

Spraying activities were commenced by the 137th M.C.D. on the 5th of January, and the 95 square mile area was completed during the first week of April; an area of about eight square miles around the Mondragone bathing beach was treated by an Allied Force Headquarters team. Every house, stable, pigsty, cellar and grass shelter that it was possible to find, was treated. In cases where houses were flooded, access was obtained by boat, but it became necessary to return at a later date, following the recession of the waters, to give the ground floors a proper spraying; in addition, there were instances where certain rooms were locked, and because no key was readily available, treatment had to be deferred to a later date. These temporarily unsprayed rooms provided sanctuary for mosquitoes, which resulted in abortive increases in mosquito densities, and definitely indicated the need for complete overall spray application.

The number of teams varied from two to three, each consisting of an American soldier acting as foreman and four Italian soldier laborers. At times each man operated his own Dobbins knapsack sprayer, but usually two of the men were detailed to a knapsack sprayer having an eight foot extension spray rod (devised and provided by Malaria Demonstration Unit, A.C.), one man operating the pump, the other the extension rod. In this manner, high ceilings were adequately treated.

It was of interest to note, that in the bonifica, which had been sprayed the previous season, the people welcomed back the spray crews with open arms; whereas in the areas to be treated for the first time, particularly the town of Castelvolturno, the people were quite hostile toward the temporary inconvience of a disordered household. Once the people had experienced the benefits of DDT, they were continually asking for a return performance!

A summary of spraying activities, exclusive of the Mondragone AFHG area, will be found in Table II. A total of 1,383 houses required 1,269 pounds of 100% DDT concentrate, which amounts to about 0.92 pounds per house. Application was made at the rate of approximately 83 milligrams of DDT per square foot. The discrepancies in the amounts of DDt used existing between urban and rural areas may be explained by the smaller type of house in the towns.

At the start of this project Dr. Henry W. Kumm (Rockfeller Foundation) voiced the opinion, that it was very difficult sometimes, particularly in a war torn area or in an area about to be occupied, to estimate DDT requirements on the basis of surface to be treated; he suggested that estimates might be made on the basis of population. In the Castelvolturno project it was found, that with an application rate of 83 milligrams per square foot, about two ounces (1.14 quarts of 5% solution) of DDT were required per person. Although population difference between rural and urban areas had a marked effect on the amount of DDT applied, it is felt, in the light of the highly satisfactory results obtained this season, that estimates might well be made on the basis of two quarts of 5% solution per person.

Entomological investigations - Inspections for hibernating mosquitoes by an entomologist from the 15th Medical Laboratory commenced 22 December 1944, and weekly visits to the Castelvolturno bonifica were maintained thereafter until the end of September 1945. Mosquito counts, in general, were made in an upstairs bedroom, a stable a pigsty at each station visited, using methods similar to those employed by the Malaria Demonstration Unit, A.C., in 1944. Total mosquito counts were not made; rather a specified area (preferred resting place) in each room was inspected and counts made accordingly; total counts were only made in pigsties. Average wall and ceiling space inspected was as follows: bedrooms- 23 square yards; stables - 27 square yards; pigsties - 14 square yards.

A total of twenty-three adult inspection stations and sixteen larval inspection stations were set up in the Castelvolturno Bonifica and Qualiano areas (see map). In addition, during July and August, inspections were made in houses other than the regular stations, many being in that portion of the bonifica north of the river and others were in the Licola and Varcaturo areas to the south; these varied in number from four to sixteen per week depending on how much time was available. All of these houses had been sprayed. Mosquitoes were brought into the laboratory for determination, given the opportunity for oviposition, and watched for signs of DDT intoxication.

In April it was decided that an area of untreated houses should be set up for comparison with the Castelvolturno project. The Bonifica di Sessa was chosen (see map). It is a thinly populated area lying just south of the Garigliano River and the town of Minturno, consisted of the small village of Cellole (population 3,500?) and a few scattered farm houses. It was here, after crossing the Volturno River at Capua in October of 1943, that the Allied Armies were held up for six long, dreary winter and spring months before they were able to force a break through and join forces with the Anzio beachhead on the way to Rome. As a result of German destruction of the pumping station near the Garigliano River, the central portion of the bonifica was completely flooded. forming a marshy lake choked with vegetation about three and a half miles long and a half mile wide. In addition, anopheline larval habitats were to be found in numerous bomb craters, heavily overgrown canals and ditches and in a few small streams scattered throughout the area. Seven adult and seven larval inspection stations were established; because of the tremendous numbers of mosquitoes present, inspections were placed on a semi-month basis. Anyone who is not familiar with the habits of anophelines of the maculipennis group can hardly appreciate the tremendous populations which build up in an uncontrolled area. Because of their house-and stable-invading affinities, inspections for these anophelines are greatly simplified. In the Sessa Bonifica, mosquitoes were so abundant, the walls and cobwebs were black with them, and on being disturbed they sounded like a swarm of bees; in one pigsty, it was estimated that there were easily a thousand mosquitoes per square yard of wall surface.

December and January were negative, at least in the houses sprayed the previous season; other houses showed moderate numbers (as high as thirty-five) of hibernating adults. Mosquitoes brought into the laboratory at this time failed to feed or oviposit. Blood engorged anophelines were found in one pigsty on 28 D ecember and 12 January. The first anopheline larvae (Anopheles claviger) were observed 19 March; larvae (4th instar) belonging to one of the members of the maculipennis complex were not seen until 12 April. This latter observation, coupled with the fact that large numbers of males and females of Anopheles maculipennis (broadly speaking) were soon in the Sessa Bonifica on 28 April, suggests that oviposition probably commenced during the middle of March and the first brood appeared around the middle of April.

Anopheles claviger larvae were fairly common early in the year, but with the coming of warm weather its numbers fell off sharply.

Of the maculipennis group, Anopheles messeae was the predominant

species early in the season, where ovipositions occurred; June collections showed a preponderance of Anopheles labranchiae but by August Anopheles messeae had resumed its former position.

Anopheles sacharovi eggs were obtained on two occasions from the Castelvolturno area during the last week of May.

The results of adult mosquito inspections have been summarized in Tables III and IV. In the Castelvolturno area during June, three stations had appreciable increases in adults far out of proportion to anything occurring in the remaining stations. Their monthly totals were as follows: Station TII - 45 adults. Station IV - 154 adults, and Station V - 84 adults. The reason for the rise at Station III is not understood, because it dropped of its own accord in July and only nineteen anophelines were found during the following three months. Investigations of Stations IV and V revealed two outdoor ovens and a wine cellar which had escaped the original spraying; after treating these (avoiding the remaining portions of the houses), adult numbers diminished, but continued to prevail at a relatively low level. There were one or two other instances where it was necessary to return and spray an overlooked room or a formerly flooded outhouse, but in each case the spraying was restricted to the room or outhouse in question. In general, there was a slight buildup in the mosquito population along about the middle of July, but the numbers were insignificant compared with the Sessa comparison area, and judging from the spleen and parasite surveys conducted in August, they were too low to have any effect on malaria transmission.

As mentioned previously, additional checking stations, other than the regular ones, were visited at random during July and August. As expected, the numbers of adults recorded were in complete accord with the current situation existing elsewhere in the Castelvolturno Bonifica.

Average monthly densities (per quare yard of preferred resting surface), of adult anophelines have been summaraized at the bottom of Tables III and IV. The profound difference existing between the Castelvolturno and Sessa areas will readily be seen. Whereas in the Castelvolturno area, monthly densities have been reduced to fractions of mosquitoes per square yard, in the Sessa area they are close to two hundred mosquitoes per square yard at the height of the season. During the entire seven and a half month period following DDT spraying a total of 1,095 anophelines were captured in regular inspection stations in the Castelvolturno area; compared with this, in the Sessa Bonifica, more anophelines were observed in a single catching

stations on one visit than were collected during the entire season at Castelvolturno.

The results of the larval surveys are to be found in Table V. Because of the scarcity of adults in the Castelyolturno area. anopheline larvae became very difficult to find. Although larvae must have been distributed rather evenly throughout zones C.D.E and F (Castelvolturno) as well as in the Varcaturo Bonifica, judging from the records of the adult stations, their densities were extremely low. Elsewhere in the experimental area, favorable aquatic situations were scarce or non-existent, except in the bonifica north of the Volturno River; even here, while there was an abundance of favorable situations, larvae were practically non-existent. On the other hand, while not outstanding, collections in the Sessa Bonifica demonstrated reasonably large numbers of larvae. Because of the tremendous adult population it was anticipated that a greater number of larvae would have been found. It is presumed that the heavily vegitated marsh lake was the principal source of anophelines; if this is true, it is quite possible, considering the extensiveness of the lake, for a large anopheline population to be present yet density in any one location to be low.

As originally planned, no larvae control was to be permitted in the experimental area. Unfortunately, a small amount of Paris green hand casting was done by the Italians in a few isolated localities, but after noting how carelessly it was accomplished and how many places were overlooked, it was felt that their work was inconsequential. The AFHQ bathing beach section at Mondragone (eight square miles), however, was oil larvicided in addition to being house-sprayed, but its location in the northwestern corner of the experimental area prevented it from having any unfavorable influence on the project.

In summary it can be said, that with the exception of a 96% larval reduction in April, there has been a 99% reduction of both anopheline adults and larvae in the Castelvolturno area, as compared with the Sessa comparison area for the months of April, May, June, July, August, and September.

Spleen and parasite surveys - As mentioned previously, three spleen and parasite surveys of the inhabitants of the Castelvolturno Bonifica (Zones A-F) were conducted by the Malaria Demonstration Unit, A.C., during the course of their studies in 1944. Surveys were made in May, August and October. Only children between the ages of 5 and 15 years of age were examined; spleen sizes were recorded after the method of Schuffner.

At the beginning of the present project, another survey was initiated in the same area in January Two additional surveys were undertaken this season, in May an during the last two weeks of August. Experienced personnel were kindly loaned by the Malaria Demonstration Unit, A.C., and slides were examined by technicians from the laboratory of Professor A. Missiroli, Instituto Superiore di Sanita, Rome.

The January survey, in addition to the Bonifica di Castelvolturno included the town of Castelvolturno, which was DDT-sprayed for
the first time this year, but which had received a minor amount of
pyrethrum spraying by the Italians the previous season. In May
the survey was extended to include the Bonifica di Sessa comparison
area and the town of Cellole. The results of these surveys are
summarized in Tables VI and VII.

As pointed out by Hackett (1937), spleens persisting in winter "indicate en masse precisely what we wish to know, namely the intensity of the malaria to which the population has been previously exposed" .* In the Castelvolturno Bonifica, at the start of DDTspraying operations, there was a splenic index in May 1944 of 43 with the average spleen having a value of 1.6 corresponding to position P of the average spleen. This alone is not particularly significant, but if one considers that there was a corresponding parasitic index of 21%, one might presume that there had been a fair amount of transmission taking place the previous fall. By May of 1945, after one season's limited experience with DDT, the splenic index had only dropped one point (42%), the value of the average spleen had remained the same (1.6), but the parasitic index had dropped to 5%. It is unfortunate that these studies are being terminated before it is possible to make another survey this coming winter; such a survey should provide conclusive proof that there has been a greatly reduced malaria experience as a result of large scale DDT operations completed early in 1945. The fact that there has been a reduction in the parasitic index, at the height of the transmission season from 12% (August 1944) to 1% (August 1945) and a previous high of 21% in May 1944, is indicative that malaria transmission has been decidely on the wane; coupled with this, there has been a definite shift to the left in the degree of splenomegaly. which suggests that malaria transmission in 1945 has been nil. Unfortunately information is not available to make a specific breakdown of positive smears except for the last survey made in August;

*Hackett, L.W. "Malaria in Europe", Oxford University Press, London: Humphrey Milford (1937) of the six positive smears, one contained Plasmodium falciparum and five P.vivax.

While the indices in Castelvolturno town have in general been lower than those in the bonifica, little information can be obtained from them, as we have no means of comparing the two years' experience.

On the other hand, the conditions found existing in the comparison area of the Sessa Bonifica and the town of Cellole are of extreme interest. In May of 1945, there was a splanic index of 56%, with the average spleen having a value of 1.9, and a parasitic index of 18%. By August the splenic index had risen to 63%, with an average spleen value of 2.2 - a definite trend to the right in degree of splenomegaly; the parasitic index was now 41%. Of the 87 positive smears examined, 30 (34%) contained Plasmodium vivax, 53 (61%) demonstrated P. falciparum and 4 (5%) were mixed infections; gametocytos were found in 35% of the smears.

In addition, certain statistics, although incomplete, are available from the local civilian health officer. Cellole has a population of approximately 3,500. During 1944, there were officially reported 822 cases of malaria between May and December. This past season, there have been 1,058 cases come to official notice from January through the middle of August. In addition there have been twenty deaths attributed to malignant tertian infections; in all cases, parasites of Plasmodium falciparum were found. Considering these facts, the situation in the Bonifica di Sessa and Cellole town is in marked contrast to that existing at Castelvolturno. The high incidence of parasitism, together with the preponderance of Plasmodium falciparum infections and gamotocyte carriers is indicative that malaria of epidemic proportions is present.

SUMMARY

Between January and April 1945 a single application of 5% DDT in kerosene was applied to the interiors of all houses and other shelters covering an area of approximately 95 square miles at the mouth of the Volturno River, near Naples, Italy. Interior surfaces were treated at the rate of about 83 milligrams of DDTper square foot; this in terms of population amounted to about 2 ounces (1.14 quarts of 5% solution) of DDT per person. Larviciding activities were carried on around the Mondragone bathing beach area (approximately eight square miles) in the northwestern corner of the experimental area; elsewhere, however, no larviciding was accomplished except for a small amount of extremely localized and desultory Paris green handcasting by the local Italians.

Entomological investigations indicated the following species of anophelines to be present in the area: Anopheles claviser, A. Messeae, A. labranchiae, and a sacharovi. Anopheles labranchiae appeared to be the dominant anopheline during June and July. Weekly larval and adult inspections were made at regular stations from December 1944 through September 1945; during July and august, additional treated stations were inspected at random. In April, an untreated comparison area was established in the Sessa Bonifica, just to the north and separated from the Volturno River basin by a range of hills. Because anophelines were so abundant, inspections were placed on a semimonthly basis. With the exception of a 96% larval reduction in April, there has been a 9% reduction of both anopheline adults and larvae in the Castelvolturno area, as compared with the Sessa Bonifica for the months of April through September.

Spleen and parasite surveys, of children between the ages of 5 and 15 years of age, were conducted in the Castelvolturno Bonifica over a period of a year and a half and in the Sessa Bonifica during the past year. In the Castelvolturno area, a splenic index of 43% together with a parasitic index of 22% made during May 1944 is indicative of a considerable amount of transmission the previous autumn. By August of 1945, the splenic index had dropped to 25% and the parasitic index to 1%; together with this drop in the spleen rate, the degree of splenomegaly has shown a decided shift to the left, suggesting that malaria transmission during 1945 had practically ceased.

On the other hand splenic indices in the Sessa Bonifica had jumped from 56% to 63% between May and August 1945 and the degree of splenomegaly was shifting to the right. The parasitic index had also moved from 18% in May to 41% in August, and 61% of the infections were caused by <u>Plasmodium falciparum</u>. These statistics, together with the information from the local health officer to the effect

that therehad been 20 deaths dur to malignant tertian infections in the area this summer, indicates that malaria of epidemic proportions was present in the unprotected Sessa Bonifica during 1945.

ACKNOWLEDGEMENTS

The writer wishes to express his deep appreciation to the following individuals, without whose wholehearted cooperation, this study could not have been attempted: Col. W.S. Stone, M.C. (Chief, Preventive Medicine Section, Office of the Surgeon MTOUSA), Dr. F. L. Soper, Dr. H.W. Kumm, and Dr. I.A. Richl (all of the Rockefeller Foundation), Captain L.M. Klashman, Sn.C. and Sgt. C.R. Collins (137th Malaria Control Det.), Captain R.A. Fisher, Sn.C., 2nd Lt. A.W. Ziegler, Sn.C. and Tec 4th C.S. Black, Jr. (all of the 15th Medical Laboratory).



TABLE II

SUMMARY OF DDT SPRAYING ACCOMPLISHMENTS IN THE CASTELVOLTURNO AREA

		RURAL	RURAL AREAS		URBAN AREAS	SI
	Bonifica	Bonifica	Bonifiche	Largo di Ba-	Castelvol- Villa	Villa
	volturno	volturno	turno and	Qualiano	Town	Town
	(South	(North)	Licola,	Area		
Gals of DDT-Kerosene used	169	347	105	834	242	569
Pounds of DDT conc. used	314	158	48	380	110	259
No. of houses treated	255	146	36	313	275	313
No. of persons per house (ave.)	6 (?)	*6.25	(8) 9	6 (7)	*5.5(?)	*16 (?)
Gals. of DDT-Kerosene per house	2,71	2.37	2.64	2.7	0°0	1,8
Quarts of DDT per person	1.8 (?)	7° C	1.9 (?)	1.7 (?)	0.64	0.45
Grams of DDT conc. per person	93.1 (?)	74.4	100.8 (?)	93.9 (?)	23.3	23,5
Quarts of DDT per 1000 sq. ft	**1.54(?)	***1°63	**1.66(?)	ç~	Ç	¢
Grams of DDT conc. per 1000 sq.ft	79.7 (?)	84.1	86.4 (?)	ç	٥-	·
#Domiletion actimetes obtained localin	- 1	0+000	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	60 Pollower Gootelton Hille Litemon-EOO Gootelton	- FOOO	Tar Thursday

*Population estimates, obtained locally, as follows: Castelvolturno-1500, Villa Literno-5000, Castelvolturno Bonifica-963 (actual count)

**Average interior wall space estimated to be 7000 sq.ft.

Type 1-4551.75 Sq.Ft. (99 houses), ***Three house types were involved, with the following interior wall space: Type II-7922.75 sq.ft. (33 houses), Type III-9952.50 sq. ft. (14 houses)

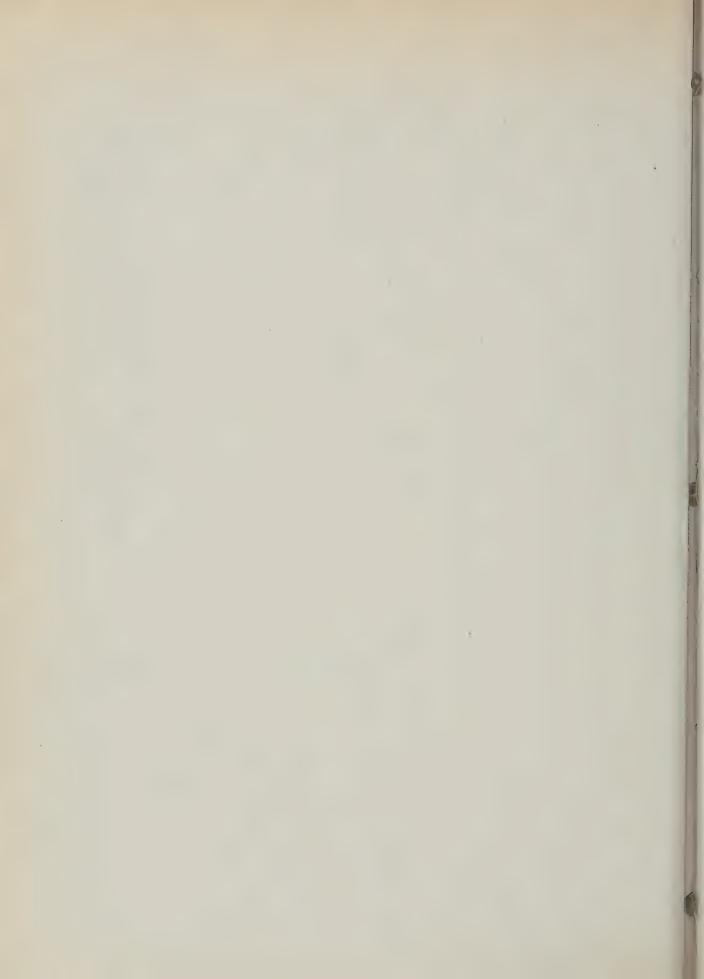


TABLE III AVERAGE MONTHLY ANOPHELINE ADULT DENSITIES PER SQUARE YARD OF EXAMINING SURFACE .. CASTELVOLTURNO AREA *

	EXMIN-	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
ED SQ	. YDS.		(DE)			-		730		
C-I (B.P.S.)	75	0.00	O.OO (DDT)	0.00	0,00	0.00	0.03	0.01	0.01	0.01
C-II (B.P.S.)	4.9	0.42		0.00	0.00	0.00	0.13	0.03	0.01	0.06
C-III (B.P.S.)	.95	0.14		0.00	0.01	0.01	0.09	0.01	0.01	0.03
C_IV (B.P.S.)	76	0.19		0.00	0.01	0.04	0.43	0.04	0.06	0.05
C-V (B,P.S.)	59	0.14		0.00	0.01	0.01	0.28	0.05	0.08	0.27
C-VI (B.P.S.)	40	0.00		0.00	0.00	0.00	0.00	0.15	0.19	0.15
C-VII (B.S.)	90	0.00	1 .	0.00	0.00	0.00	0.01	0.08	0.14	0.05 Turn
C-VIII (Pill box)	16	0.00	1 ,	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-IX (S.)	22	0.00		0.00	0.00	0.00	0.09	0.02	0.06	0.02
C-X (B.S.)	80	0.00	8 /	0.00	0.00	0.00	0.01	0.00	0.00	0.01
C-XI (S.)	23	0.00	, , ,	0.00	0.00	0,00	0.00	0.00	0.00	0.00
C-XII (B.S.)	48	0.00	1	0.00	0.00	0.02	0.04	0.03	0.01	0.06
C-XIII (P.S.)	32	0.00		0.00	0.00	0.00	0.00	0.01	0.00	0.03
C-XIV (B.S.)	33	0.00	5 4	0.00	0.00	0.01	0.01	0.02 (DDT)	0.00	0.01
C-XV (S.)	. 18	0.00 (DDT		0.00	0.00	0.00	0,00	2.47	0.12	0.13
C-XX (B.P.S.)	48		0.00	0.00 (DDT)	0.00	0.00	0.01	0.00	0.00	0.00
C-XXI (B.P.S.)	48		0.00		0.00	0.00	0.00	0.00	0.00	0.00
C-XXII (B.P.S.)	48		0.00 (DDT)			0.00	0.01	0.00	0.00	0.00
C-XXIII (B.P.S.)	48			0.00	0.00	0.00	0.00	0.00	0.00	0.00
C-XXIV (B.P.S.)	48			0.00 (DDT)	0.00	0.00	0.01	0.00	0.01	0.00
C-XXV (B.P.S.)	48	(DDT	0.00		0.00	0.00	0.00	0.00	0.00	0.00
C-XXVI (Stair well	1) 8		0.00	0.00 (DDT)	0.00	0.00	0.15	0.18	0.06	0.31
C-XXVII (B.P.S.)	48		0.00		0,00	0.00	0.01	0.01	0.05	0.03
MONTHLY AVERAGE *For convenience,								0.13		

** Station symbols B- bedrooms, P - pigsty, S - stable

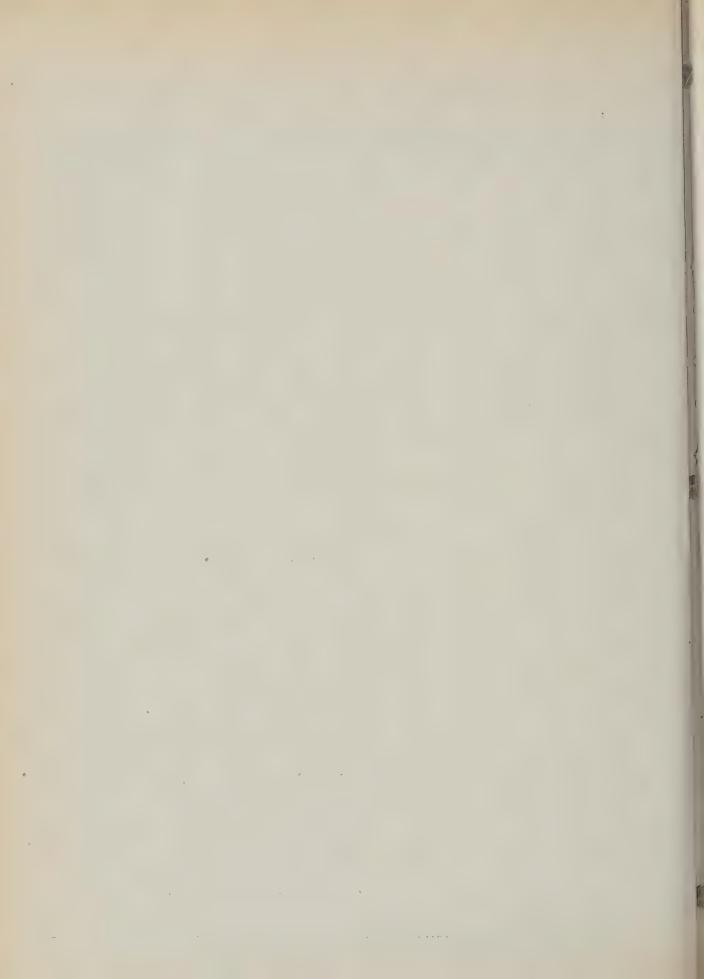


TABLE IV

AVERAGE MONTHLY ANOPHELINE ADULT DENSITIES PER SQUARE
YARD OF EXAMINING SURFACE - BONIFICA DI SESSA *

** STATION	AREA EXAMINED SQ.YDS.	APRIL	MAY	JUNE	JULY	AUG	SEP
S-I (G.S,)	14	1.00	17.86	35.71	*** 142.85 ***	Discont	inued
S-II (S.)	24	0.58	11.45	25.00	85.55	50.00 ***	50.00
s_III(s.)	6	4.83	27.00		166.66	116,66	116.66
S-IV (S.)	19	1.11	4653	13.16	78.94	78.94	78.94
S-V (S.)	71	1.73	14.08	70.42	7-1-0	112.67	
S-VI (P.)	10	50.00	200.00	1000.00		700.00	700.00
s-VII (s.)	20		18.00	25.00	dt. gp en en gp	55.00	55.00
MONTHLY AV	ERAGE	9.87	41.84	167.04	118.50	185.54	185.54

^{*} For convenience, semi-monthly inspections have been combined into monthly totals.

^{**} Station symbols, G.S. - Goat shed, P. - pigsty, S- stable.

^{***} Based on estimates of over 1000 mosquitoes



TABLE V

AVERGE MONTHLY ANOPHELINE LARVAL DENSITIES PER TEN DIPS
OF EXAMINING SURFACE - CASTELVOLTURNO AND SESSA AREAS

STATION	TYPE	APRIL	MAX	JUNE	JULY	ÀUG	SEPT
C-1 C-2 C-3 C-4 C-5 C-6 C-7 C-8 C-9 C-10 C-11 C-12 C-13 C-14 C-15 C-16	Canal Flood area n Canal n n H Lake front Canal n Ditch Canal n	0.00 0.00 0.75 0.00 0.00 0.00	0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0	0.00 0.00 0.00 0.20 0.00 0.00 Dry 0.00 Dry 0.00 0.00 Dry	0.00 0.00 0.00 0.00 0.00 0.00 Dry 0.00 Dry 0.50 0.00 Dry 0.00	0.00 0.00 0.00 0.00 0.00 0.00 Dry 0.00 Dry 0.00 0.20 Dry 0.00	0.00 0.00 0.00 0.00 0.00 0.00 Dry Dry 0.00 Dry 0.00 0.00 Dry
MONTHLY	AVERAGE	0.17	0.21	0.32	0.06	0.02	0.00
	Swamp Canal "" " " Flood area Swamp	0.00 0.00 0.00 2.00 5.00 2.00 19:00	2.00 0.00 0.00 10.00 20.00 47.00 51.00	21.00 0.00 Positiv 35.00 22.00 Abundan	0.00 e 6.00 Dry 0.00	11.00 0.00 0.00 Dry 10.00 0.00	MI # 31 (4) '40 (4) (4) (4) MI # 41 (4) (4) MI MI MI MI MI MI MI MI MI
MONTHLY	AVERAGE	4.00	18.60	11.60(*) 1.00	4.00	



TABLE VI SPLEEN INDICES IN CASTELVOLTURNO AND SESSA AREAS (1944-45)

LOCALITY AND DATE	NO.	SPLEEN		%	F S	PLE			E SPLEEN
	EXAM.	INDEX	0	P	I	2	38:4	Value	Position
0 4 3 3 4 5 6 6 6									,
Castelvolturno Bonific									
May 1944	485	43%	57	32	10	1	0	1.6	P
August	575	.43	57		13	2	0	1.6	P
October	533	39	61	22	14	3	0	1.6	P
January 1945	355	27	74	15	10	1	P	1.4	P
May	410	42	58	30	11	1	0	1.6	P .
August	423	25	75	20	5	0	0	1.2	P
Castelvolturno Town					5,020				·
January 1945	94	22	78	13	6	3	0	1.3	P .
May	104	39	61	26	10	3	0	1.6	P
August	159	25	75	21	4	0	0	1.3	P
Sessa Bonifica and Cel									
May 1945	228	56	44	26	22	8	0	1.9	P
August	210	63	37	22	27	12	2	2.2	1

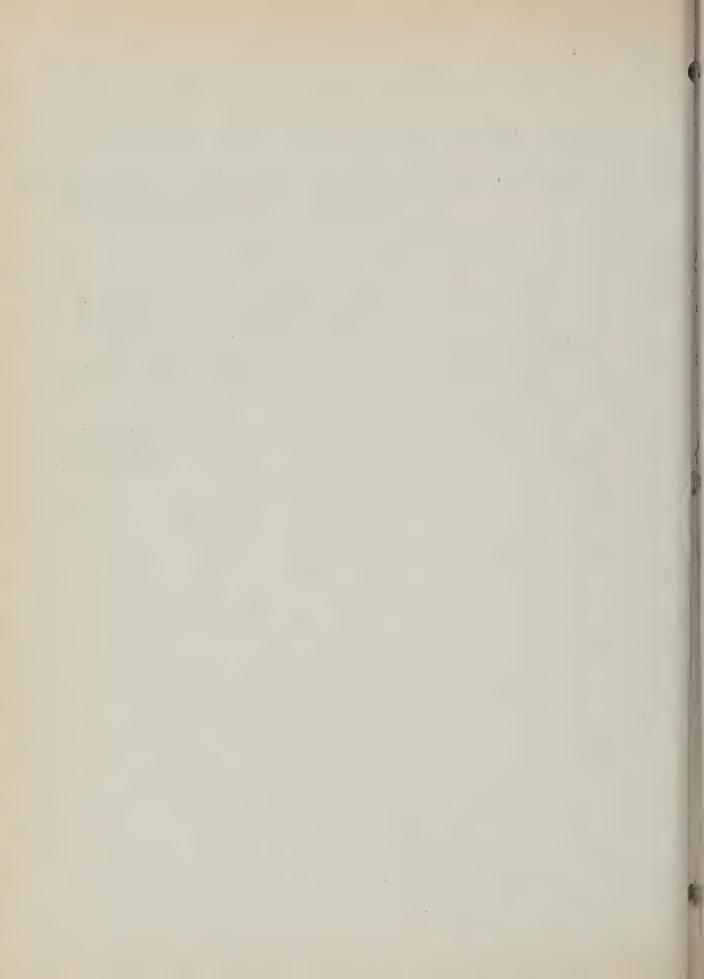
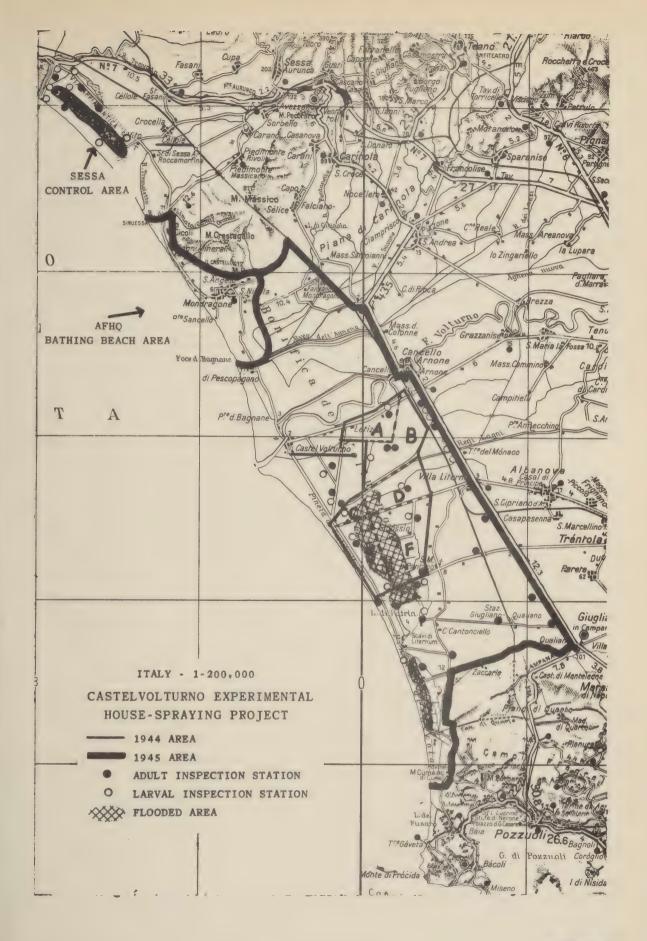
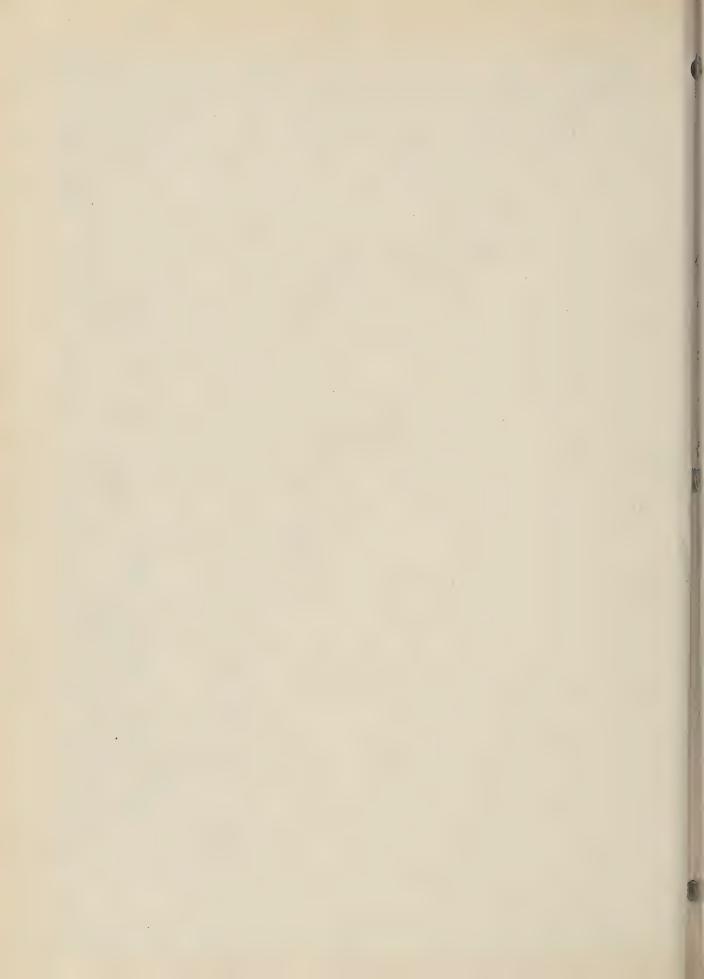


TABLE VII

PARASITE INDICES IN CASTELVOLTURNO AND SESSA AREAS (1944-45)

LOCALITY AND DATE	NUMBER EXAMINED	NUMBER WITH PARASITES	PERCENT WITH PARASITES
Castelvolturno Bonifi	Ca.		
May - 1944	485	101	21%
August	575	67	12
October	533	41	8
January 1945	355	10	3
May	410	20	2
August	423	6	<u> </u>
Castelvolturno Town			
January-1945	94	2	2
May	104	7	7
August	159	12	8
O D	33-3- Mann		
Sessa Bonifica and Cé	1101e Town	10	18
May -1945 August	210	40 87	41
August	2.10	07	444





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HEADQUARTERS
2655th MALARIA CONTROL DETACHMENT (OVHD)
Office of the Malariologist, MTOUSA
APO 512, U.S. ARMY

OIL SPRAYING EQUIPMENT FOR THE

A-20 (DOUGLAS) AND PT-17 (STEARMAN) AIRPLANES.

WILLIAM J. WYATT
Major, Sanitary Corps.

15 September 1945.

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Oil Spraying Equipment for the A-20 (Douglas) and PT-17 (Stearman) Airplanes.

I. INTRODUCTION.

The use of the airplane to apply liquid larvicides, in particular DDT in oil, to marshy areas as a mosquito control measure was tested in the Mediterranean Theater of Operations during the summer of 1944. As a result of these trials, it was learned that an A-20 airplane could safely carry 300 gallons of liquid and release this above a marsh at altitudes of 25 to 100 feet depending on terrain and wind conditions.

At the close of the 1944 malaria season, it was decided to continue studies of oil spraying equipment for the A-20 airplane, and these studies were conducted during the winter of 1944-45. As a result of these efforts several A-20 airplanes were fitted out with 300 gallon tanks mounted in the bomb bay with a three inch discharge line opening below the underside of the fuselage of the airplane; a valve opened and closed by a hydraulic piston released or shut off the flow of oil from the tank to the discharge line.

Early in May 1945, two of the cil spraying A-20 airplanes were sent to the Leghorn area to apply DDT in oil larvicide to the water surfaces of the region. Since the atomizing device of the sprayer had been constructed to produce a spray stream that would deposit oil at the rate of two quarts per acre over a swath 300 feet wide and most of the water surfaces in the Leghorn-Pisa area consisted of a network of canals which because they were so extensive and their banks mined made the use of an airplane both necessary and feasible. experiments were undertaken to determine the means of making efficient use of the airplanes in the application of liquid larvicides to canals. Initial trials in which the airplane was flown past a point in a direction at right angles to the line of a series of papers placed at 300 foot intervals showed that with the same height of release and under approximately equal conditions of temperature and wind the width of the swath covered varied with the amount of liquid in the tank. With the diameter of the discharge orifice set at two inches and the airplane flying at a height of 50 feet, the width of the swath covered varied from 420 feet with the tank full to 200 feet with the tank only 1/3 full; in addition, the average number of droplets per square inch varied from 25 with the initial flow from a full tank to 15 at the time the level of the liquid in the tank was only 1/5 its capacity.

Tests were then conducted to determine the rate of flow from the tank during various time intervals while the airplane was in flight; results of these tests are shown in Table 1.

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Table 1. Percent of capacity (300 gallon tank) discharged from the A-20 airplane spray tank during various intervals of time after initiation of flow from a completely full tank in which the head pressure was not equalized during discharge.

the spinish property and the			and the second s	THE CONTRACTOR STATES AND ADDRESS OF THE PROPERTY OF THE PROPE
Test Number	Diameter of Outlet	Time in Minutes	Gallons Discharged	Percent of Capacity Discharged
1	2 inches	1.5	220	70
2	2 inches	1st minute 2nd minute 3rd minute	170 90 40	57 30 13
3	2 inches	1st minute 2nd minute 3rd minute	170 90 40	57 30 13
4	l inch	lst 4 1/2 min 2nd 4 1/2 min 3rd 4 1/2 min	80	57 27 16

The results of the tests shown in Table 1 indicated that some method of obtaining a constant flow of liquid from the tank would be highly desirable. Laboratory trials of various systems were conducted to devise some simple means of obtaining a constant flow of liquid from a vessel. From experience gained in these tests, it was decided to make all external openings to the tank such as filler caps, etc. airtight and to extend the air vent line entering the tank at the top to within four inches of the bottom; with these conditions, it was necessary to provide an escape for the air while filling the tank, and this was done by inserting a valve in the top of the vessel. The valve could be opened as filling began and closed when the container was full. When the valve releasing the liquid to the discharge line was opened, the outgoing fluid could be replaced only by that air which entered the tank through the terminal opening of the vent under the surface of the liquid. Fluid leaving the tank produced a suction that pulled air into the vessel, but the flow of air was retarded by the pressure of the weight of the liquid exerted on the bottom of the vent pipe. Static pressure tending to produce an increased rate of flow was greatest when the container was full, but this height of fluid exerted the greatest limiting influence on flow of air into the tank. As the depth of the liquid in the container decreased, static pressure decreased, but the pressure of the liquid at the vent outlet was less; so air could therefore enter the vessel at a more rapid rate. Thus an equalized

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flow of liquid from the tank was obtained during the time required for it to empty.

II. OIL SPRAYING APPARATUS FOR THE AIRPLANE, PT-17, U.S.A.A.F.

The installations of the front cockpit, such as seat, controls, instrument panel, etc., were removed from a PT-17 Stearman biplane to create room for a container the size of a 55 gallon oil drum. The position and manner of installation of the container, discharge line and atomizing apparatus in relation to the structure of the airplane are shown in Figure 1.

Tank: A 55 gallon oil drum was modified to make the reservoir tank; the first step being the removal of the plug caps in the end of the barrel and the sealing of these openings by welding a metal plate into them. A one inch vent line was passed through the forward end of the upper side of the barrel and projected to within four inches of the bottom side; the line extended twelve inches above the upper side of the barrel, and it was secured by welding it to the rim of the opening through which it passed into the barrel.

At the rear of the upper side of the drum an opening the diameter of the filler cap assembly of the main gas tank of a P-47 was cut, and the outer portion of the filler cap assembly welded into the opening. A well six inches deep fashioned from sheet metal was attached surrounding the filler cap, and a line extending from the lowest point of the well passed around the outside of the barrel and out the bottom of the fuselage. Any fluid overflowing from the tank is thereby drained off and discharged outside the airplane.

At a point on the under side of the drum approximately diametrically opposite the filler cap, an opening one inch in diameter was cut, and coupling for one inch pipe was welded in place with the edge of its inner circle concentric with the edge of the hole.

Mounting of the tank in the airplane: Two pieces of wood, 4 x 4 inches in dimension, were placed across the frame of the airplane at the bottom of the space originally utilized for the forward cockpit; they were separated by a distance slightly shorter than the length of a 55 gallon oil drum and were bolted to the frame. As the central portion of each wooden girder had been cut out on an arc of the same radius as that of the oil drum, they formed a cradle for the drum. Each end of the barrel was moored to its respective wooden girder by a metal band passing over the drum and attached to the ends of the girder; the band was tightened in place by means of tension nuts at each of its ends. Checking of these nuts at intervals will

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insure the security of the position of the drum.

When the drum had been fastened in place in the plane, a one inch pipe was screwed into the coupling on its under side; the pipe was extended through the fuselage to a point eighteen inches below the barrel. The pipe was terminated at this point and a right-angle pipe "L" coupling fitted to its end. A plug type valve was connected to the lower end of the coupling, and a one inch pipe twelve inches in length extended from the valve. The pipe was braced by means of rods from it to the ends of the rear wooden girder supporting the tank.

Valve: A simple plug type valve placed in the discharge line controls the release of liquid from the tank. The valve is operated manually through a direct connection to a lever in the pilot's cockpit as shown in Figure 1. No calibration of the lever to control the rate of flow is used; the valve is either opened completely or closed.

In lieu of furnishing the pilot with a gauge to register the level of the fluid in the tank, a plexi-glass plate was mounted in the floor of the cockpit directly over the atomizer; so the pilot can watch the flow of the oil spray. Irregular supply causes spurting of the stream just at the end of the tank.

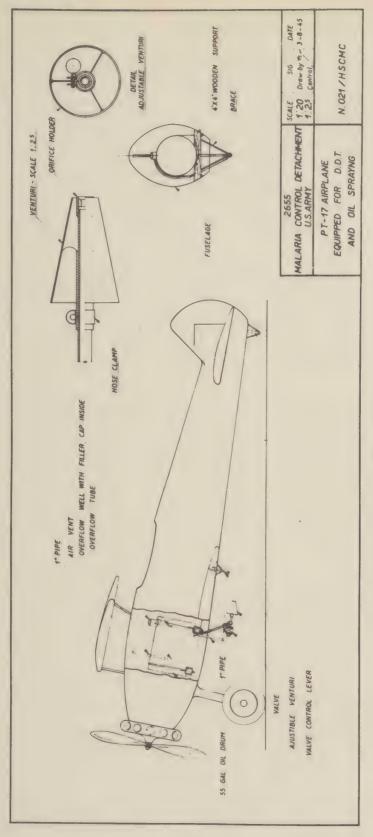
Atomizing apparatus: The atomizer consists of a truncated cone five inches in diameter at its open base and two inches in diameter at its top. The cone was fitted over the pipe with its base forward and its long axis parallel to the pipe. With the airplane in flight, air is cooped through the cone and converged on the stream of oil flowing from the pipe. The cone was attached to the pipe by means of a hose clamp; this permits adjustment of the position of the cone, so that the distance between the planes of the end of the pipe and the terminal orifice of the cone may be altered.

Performance

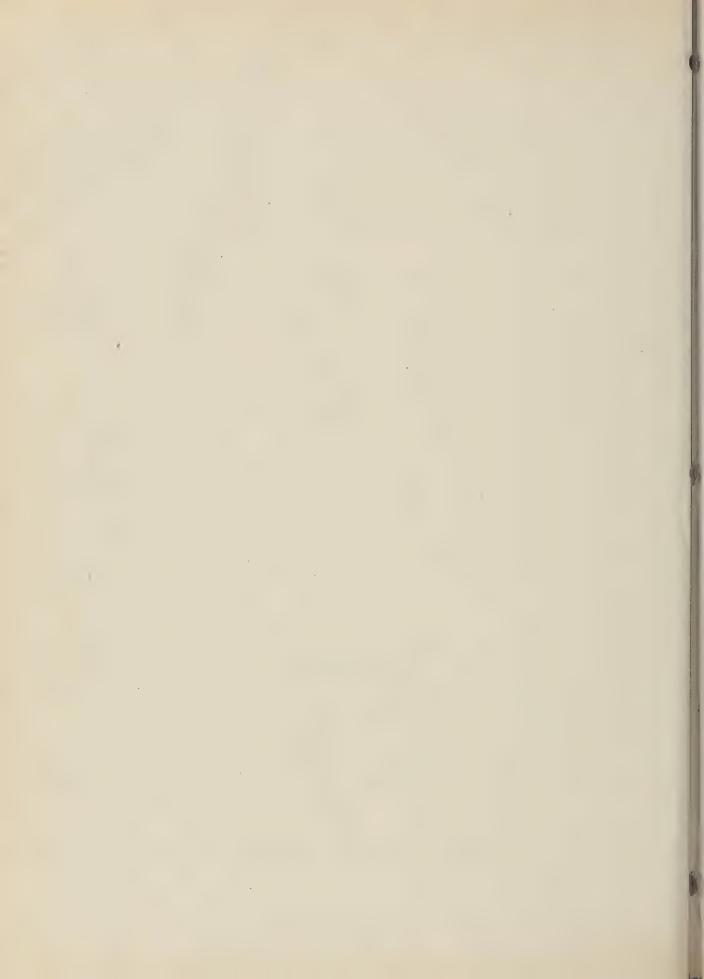
Tests performed previously with the A-20 airplane, shown in Table 4, page 36, had demonstrated that the fluid sealed air vent effectively balanced the static head pressure in the tank and provided a uniform rate of flow of liquid from the tank while it was emptying. Using a discharge orifice having a diameter of 3/4 of an inch, six minutes and 25 seconds were required for the 55 gallon tank of the PT-17 (Stearman) sprayer to empty; this means that 34 quarts of liquid were released per minute and that a linear distance of approximately ten miles would be covered in the time required for the tank to empty. Plane speed was approximately 90 miles per hour.

Determination of coverage of sprayed surface. The oil used in the various trials to determine coverage was colored with the oil soluble

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dye, Sudan III, mixed with oil at the rate of one pound of dye to each 50 gallons of oil. The number of drops per unit area and the diameters of these drops were obtained by the use of jump cards and magnesium oxide coated plates. The stain size/drop size relationship curve for No. 2 Diesel oil and the paper used for the jump cards was kindly calculated by Mr. J. W. Siddorn of the Porton Experimental Station. A water suspension of magnesium oxide was applied to clean glass slides; the suspension was used in a quantity sufficient to provide as heavy a deposit of magnesium oxide as could be obtained without cracking of the film when it dried. Only the heavy uniform uncracked films were selected from the slides prepared.

The oil was released both with the airplane flying crosswind and with it flying upwind. In crosswind flights the jump cards were placed at 30 foot intervals in a line at a right angle to the line of flight, some trials were made using ten foot intervals, and in upwind flights the jump cards were placed in a series both to the right and to the left of the card over which the plane passed. A magnesium oxide coated plate was placed in the center of each jump card.

After a test flight had been made the jump cards and magnesium oxide coated plates were carefully labeled and brought into the laboratory. Measurements of stain diameters were made by means of an eyepiece micrometer placed in the ocular of a stereoscopic microscope, and the number of drops per square inch were counted.

Calculations of material per acre were made in the following manner. The diameters of 50 drops on each plate were measured and averaged, and the average drop diameter for that plate used in the following equation: 524 d3 times the number of drops per square inch times the number of square inches in an acre (6,272,640) divided by the number of cubic millimeters in a quart equals the quarts of liquid per acre represented by the stains on the jump card and the magnesium oxide coated plate, (for rapid calculation this may be shortened to: d3 times the number of drops per square inch times 3.47). As a 5% solution of DDT containing approximately 0.45 lbs. of DDT per gallon was used, each quart of solution contained about O.11 lbs. of DDT; so the number of quarts of oil falling on a given swath were multiplied by 0.11 to find the pounds of DDT falling on that swath. The coverage of the swath was considered to have effective larvicidal properties if it contained 0.1 lb. or more of DDT per acre; this is equal to one quart or more per acre.

The results of the spray trials with the PT-17 (Stearman) airplane are summarized in Tables 2 and 3 and are shown in greater detail in the tables following them which represent the data on each individual flight.

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The effect of change in temperature and variation of the distance between the orifices of the atomizer of the oil spraying apparatus for a PT-17 (Stearman) airplane on the width of the spray swath and amount recovered of No. 2 Diesel oil released at a height of 50 feet from an airplane flying cross wind. Table

					REST	RICI	ED				
Average	qts/acre	2.7	2.6	0.0	1.6	1.5	1.6	4.0	, , ,	1.7	
Effective Average Swath Coverage	(Feet)	50	50	09	40	10	10	40	50	30	
ent		13%	13%	8%	47%	74%	72%	12%	13%	71%	
Quarts Recovered Lost per min.		29.7	29.0	32.0	18.0	0.6	9°6	30.0	29.7	10.0	
Quarts Released per min.		34	34	34	34	34	34	34	34	34	
Temper-Quarts ature Releas	(Fahr)	68	80	92	06	36	86	09	80	93	
Average Drop Diameter	(mm)	.24	.23	,16	206	.24	.165	. 22	.21	.286	
Range of Average Drop Diameters	(mm)	.1440	0960°	.0923	.1137	.1265	.1026	.1635	.1040	.1076	
Distance between Orifices	(Inches)	Flush	Flush	3/8	3/4	1 1/2	1 1/2	80	10	89	
Size of Outlet	(Inches)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	
Flight		12*	ω	13*	ณ	80	11	18*	14*	7	

*Flights in which the jump cards were placed at 10 foot intervals in the series; in all others the card interval was 30 feet. Note:

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The effect of change in temperature and variation of the distance between the orifices of the atomizer of the oil spraying apparatus for a PT-17 (Stearman) airplane on the width of the spray swath and amount recovered of No. 2 Diesel oil released at a height of 50 feet from an airplane flying up wind. Table

			4640	PIKT	7 1111				
Average	(qts/acre)	3,5	1.0	5.0	1 1	1.0	3.7	. !	
Effective Swath Width	(Feet)	50	30	30	none	30	40	none	
Percent		20%	82%	12%	93%	82%	4%	%16	
Quarts Recovered per min.		27	9	30	2°2	9	32.6	2°2	
Quarts Released per min.		34	34	34	34	34	34	34	
Temper-Quarts ature Release	(Fehr)	84	93	88	93	93	09	93	
Average Drop Diaméter	(mm)	.20	,16	.16	.15	,17	,16	.15	
Range of Average Drop Diameters	(mm)	.13=,26	.1421	.1030	.1316	.1223	.1026	.1316	
Size of Istance Range of Outlet between Average I	(Inches)	Flush	Flush	3/4	1 1/2	1 1/2	10	10	
1	(Inches)	3/4	3/4	3/4	3/4	3/4	3/4	3/4	
Flight		16*	0	m	10	4	17*	ເດ	

*Flights in which the jump cards were placed at 10 foot intervals in the series; in all others Table 3. the card interval was 30 feet. Note:

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Airplan	PT-17	Direction	Flight Up	Wind	Airplane PT-17 Direction Flight Up Wind Wind Velocity 8 miles per hour Altitude 50 ft. Temperature	8 miles	per hour	Altitude	50 ft.	Temperature
Airplan	Speed 9	Airplane Speed 90 miles per hour	hour	H	Larvicide Used 5% DDT in No. 2 Diesel oil	d 5% DDT	in No. 2 I	jesel oil	1	00 100
Flight	Size of Outlet	Quarts per Minute	Distance between Orifices	Paper Number	Distance from Spray Track	Number Drops per Sq. Inch	Average Drop Diameter	Material per Acre	DDT per Acre	Effective Sweth Width
	(Inches)	Inches Discharged	Inches		Feet		m/m	Qts	Lbs	
rif	.75	34	.75	3R	06					
ŗ				2R	09					
of 33	Figuring an eff of 33 feet, the were obtained:	Figuring an effective swath width of 33 feet, the following results were obtained:	th width results	Ħ	30	4	.10	0°	.001	
1)。(1	s acres c	6 acres covered per min.	nin.	H	0	54	80	4.99	.55	XXXXX
:	Average of	Average of 5 qts recovered per acre.	overed	11	30	o.	.10	.03	•003	
3).	34 qts released p	34 qts released per minute. 30 qts recovered.	minute.	2L	09					
				31	06					
					Teb 3a					

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				•	WED IV	101	נבו					
Temperature		Effective Swath Width XXXX			XXXX	XXXX						
50 ft.		DDT per Acre Lbs			.23	.13	° 04	• 004	.001	.002		
Altitude	iesel oil	Material per Acre			2.11	1.16	828	° 04	.01	20°		
s per hour	5% DDT in #2 Diesel oil	Average Drop Diameter m/m			.37	.27	°18	.16	TT.	13.		
ty 8 miles		Number Drops per Sq. Inch		0	12	17	16	ю	20.51	H.	0	
Wind Veloci	Larvicide Used	Distance from Spray Track Feet	0	30	09	06	120	150	180	210	240	Table 3b.
ss Wind		Paper	-	~	-10	4	വ	9	7	∞	o	And a champion and a
Airplane PT-17 Direction Flight Cross Wind Wind Velocity 8 miles per hour Altitude 50 ft.	Airplane Speed 90 miles per hour	uarts Distance per between inute Orifices Discharged Inches	. 75	,	Figuring an effective swath width of 60 feet, the following results		ll acres covered per minute. Average of 1.6 qts recovered	34 qts released per minute.				Andreas and second seco
Direct	90 mil	Quarts per Minute Disch	34		follow		overed 1.6 qt	eased p				
e PT-17	e Speed	Size of Quarts Outlet per Minute	3.		Figuring an eff of 60 feet, the	· notification	Average of	34 qts released p				Propint alliant the side of the common
Airplan	Airplan	Flight	ત્ય		Figurin of 60 f		1). 11 2). Av	3), 34				

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Airplane	Airplane Pr-17	Direction Flight	Flight Cro	Cross Wind	Wind Velocity 8 miles per hour Altitude 50 ft.	ity 8 mile	s per hour	Altitude	50 Pt	Temperature	
Airplane	Speed e	Airplane Speed 90 miles per hour	r hour		Larvicide Used	Used 5% D	5% DDT in #2 Diesel	iesel oil			
Flight	Size of Outlet	Quarts per Minute	Distance between Orifices	Paper Number	Distance from Spray Track	Number Drops per Sq Inch	Average Drop Diameter	Material per Acre	DDT per Acre	Effective Swath Width	
	Inches	Discharged	Inches		Feet		m/m	Qts	Lbs	XXXX	
83	. 75	34	1.5	Н	0				•		
				23	30	က္ခ	. 65	. 48	• 05		E.
Figuring an ef of 53 feet, th	g an effe	Figuring an effective swath width of 33 feet, the following results were obtained:	width esults		09	14	. 12.	1.45	°16	XXXX	LL Land
				4	06	7.5	.20	.21	0.02	R	Pi
1)。6 8 2)。Ave	acres cor	6 acres covered per minute. Average of 1.5 qts recovered	nute	വ	120	ខ្មុំ	.12	. 03	.003	ĒSTRĪ	TOTOT
3). 34	per acre. 34 qts rele	Der acre. 34 gts released per minute.	nute	9	150	N	.12	.01	.001	CTED	משקים
•		one-Tea		£	180	့	• 14	° 004	0000		
				ω	210	.25	.13*	0000	0000°		
				0	0	0					
Andrew controlled				And delicated and desired from the spirits and	Toldon Zo						

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Airplan	e PT-17	Direction	Flight Up	Wind	Vind Velocit	y 8 miles	per hour	Altitude 5	50 ft.	7
Airplan	e Speed	Airplane Speed 90 miles per hour	r hour		Larvicide Used 5% DDT in #2 Diesel oil	ed 5% DDT	in #2 Diese	1 011		So F.
Flight	Size of Outlet	Quarts per Minute	Distance between Orifices	Paper Number	Distance from Sprav Track	Number Drops per Sq Inch	Average Drop Diameter	Material per Acre	DDT per-	Effective Swath Width
	Inches	Discharged			Feet		m/m	Qts	Lbs	XXXX
4	•75	34	1.5	3R	06	0				
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	4	The man of the second of the s	-2- + -7- -7- -7- -7- -7- -7- -7- -7- -7-	2R	09	ເລ	.17	• 008	80000	
of 33 f	of 33 feet, the were obtained.	of 33 feet, the following results	results	IR	30	ស	.12	200°	. 0002	
				-	0	23	.23	.97	.11	XXXX
1). 6 2). Av	acres corerage of	6 acres covered per minute. Average of 1 qt. recovered per	inute.	11	30	11	.16	•16	.02	7
3). 34 4). 6	acre. 34 qts released 6 qts recovered.	acre. 34 qts released per minute. 6 qts recovered.	inute.	7Z	09	Ö				
					E	77.00				
					IRDIE DO.	.pg.				

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	Snead	Airplane Speed 90 miles per hour				Larvicide Used 5% DDT in #2 Diesel oil	111			0 4
irplane	3000		er nour		rarvicioe	Continue and an inches the continue printers of the	T in #2 Di	esel oil		
Flight S.	Size of Outlet	Quarts per Minute	Distance between	Paper	Distance Number from Drops po	Number Drops per	Average Drop	Material	DDT	Effective Swath Width
F	Inches	Discharged Inches	Inches		Feet		m/m	Qts	Lbs	XXXX
LO.	075	4.	6/3	3R	06					
14 14 1	(2)	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		2R	09	27	°16	. 38	°.04	
rifices	on the	orifices on the Venturi the oil	le oil	118	30	29	0.16	. 41	.05	
as so fi ittle of	it re	was so finely atomized that very little of it reached the ground	round	н	0	15	.13	11.	.01	
d man	eracur	at a temperature of 30 r.		11	30					
				25	09					
		•		31	06					

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									1
Temperature		Effective Swath Width	XXXX						
O ft.		DDT Per Acre	Lbs		60.	.07	.07		
ltitude 10	el oil	Material per Acre	Qts	\$ COMMON TO SERVICE AND ADMINISTRATION OF THE COMMON TO SERVICE AN	• 86	.63	.63		
er hour A	in #2 Dies	Average Drop Diameter	m/m		•24	.23	.22		
8 miles p	d 5% DDT	Number Drops per Sq Inch		0	18	15	17	0	
Airplane PT-17 Direction Flight Up Wind Wind Velocity 8 miles per hour Altitude 100 ft. Temperature	Larvicide Used 5% DDT in #2 Diesel oil	Distance from Spray Track	Feet	0	30	0	30	0	Table 3f.
Wind		Paper		2R	1R	Н	11	2L	
Flight Up	er hour	Distance between Orifices	Inches	80	5	le oil	round at		
Direction	Airplane Speed 90 miles per hour	Quarts per Winute	Discharged Inches	34	water to the (2)	orifices on the Venturi the oil	was so finely atomized that very little of it reached the ground at		
Pr-17	Speed	Size of Outlet	Inches	6 .75	4 (2)	on the	inely at f it res		
Airplane	Airplane	Flight Size of Number Outlet		, 9	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	orifices	was so finely atomized little of it reached t		

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		Communication Contraction Cont				11	estr	an V d		
Effective	Swath	XXXX	The second second second second		XXXX					
DDT	per	Lbs	e errode od	•04	. 18	.03	00.		• 005	
Larvicide Used 5% DDT in #2 Diesel oil istance Number Average Material	per	Qts		238	1,65	ಶ	0.0		000	
OT in #2 D. Average	Drop Diameter	m/m	7 (4) (4) (4) (4) (4) (4) (4) (4) (4) (4)	92°	.31	15	-	1	•10	
Number	Drops per Sq. Inch		7	.25	16.00	10,01	15.75		4.75	
Distance	Spray Track Sq. Inch	Feet	60	30	09	06	190		150	
Paper	CONTRACTOR MANAGEMENT		H :	82	100	- 4	LC)	ဖ	
Distance	Detween	Inches	89		h width results	y construction of the second o	inute.		inute.	
-	per	Discharged Inches	4 を		Figuring an effective swath width of 33 feet, the following results	were obtained:	1). 6 acres covered per minute.	200	34 qts released per minute.	
Flight Size of Quarts	Outlet	Inches	.75		s an effe	ained:	cres cov	per acre.	34 qts released p	4
Flight	Number Outlet		7		Figuring of 33 fe	were obt	1). 68	2	3). 34 4). 10	

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Temperature		Effective Swath Width		XXXX	XXXX							
50 ft	1	DDT per Acre		920	23.	000	.007	.01	•004	000	· · · · · · · · · · · · · · · · · · ·	
r Altitude	Diesel oil	Material Per Acre		6.93	1.94	9,62	.00	.12	• 04	.02		
es per hou	5% DDT in #2	Average Drop Diameter		09°	© N	. 21	91.	017	.12	•00		
ity 8 mil		Number Average Drops per Drop Sq. Inch Diamet		9°02	25.0	19.0	4.75	6,75	6.5	7.75	0	
Airplane PT-17 Direction Flight Cross Wind Wind Velocity 8 miles per hour Altitude 50 ft.	Larvicide Used	Distance Number Average from Drops per Drop Spray Track Sq. Inch Diameter Feet	0	30	09	06	120	150	180	210	240	Table 3h.
ss Wind		Faper	The second secon	~3	10	4	വ	9	2	∞	6	
Flight Cro	er hour	Distance between Orifices	3		h width results		minute.	inute。				
Direction	Airplane Speed 90 miles per hour	Quarts Per Minute	34		Figuring an effective swath width of 60 feet, the following results were obtained:		11 acres covered per minute. Average of 2.6 qts covered per acre.	34 qts released per minute. 29 qts recovered.				
Press	Speed	Size of Outlet			an effe		11 acres co Average of acre.	34 qts rele 29 qts reco	4			
Airplane	Airplane	Fight	0		Figuring an eff of 60 feet, the were obtained:		1). 11 2). Ave	3) . 34				

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Number Outlet per Discharged Inches Spray Track Sq. Inches Discharged Inches Spray Track Sq. Inches Discharged Inches Sq.	Average Drop Diameter m/m14 .18 .18	Distance Number Average Material from Drops per Drop per Acre Number	DDT Per Acre Lbs	Effective Swath Width XXXX
. 5L 60 0				
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Airplane PT-17 Direction Flight Up Wind Wind Velocity 8 miles per hour Altitude 50 ft. Temperature	Airplane Speed 90 miles per hour Larvicide Used 5% DDT in #2 Diesel oil	ze of Quarts Distance Paper Distance Number Average Material DDT Effective Etlet per Per Swath Minute Orifices Spray Track Square Inch Diameter Acre Acre Width	Discharged Inches Feet	75 34 1.5 3R	West sorting compath due to	distance between orifices on the IR 30 19 .15 .22 .02	1 0 28.75 .16 .41 .05	1L 30 10.00 .13 .07 .007	2L 60 0	31	Toklo &
PT-17 Dire	Speed 90 m		Inches Dis	.75	- + out	between ori					
Airplane	Airplane	Flight Size of Number Outlet		10	NA ep Poort	distance Venturia					

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Airplan	te PT-17	Airplane PT-17 Direction Flight		ss Wind	Wind Veloci	Cross Wind Wind Velocity 8 miles per hour Altitude 50 ft.	hour Al	titude 50	1	Temperature
Airplan	e Speed	Airplane Speed 90 miles per hour.	er hour.		Larvicide U	Larvicide Used 5% DDT in #2 Diesel	#2 Diese	1001	1	
Flight	Flight Size of Number Outlet	Cuarte	Distance	Paper	Distance from	Number Drops	Average Drop	Material	DDT	Effective Swath
K. A. C. AND CONTRACTOR CONTRACTOR	Inches	Discharged			Feet	non- o monho		4	Lbs	XXXX
H	.75	34	r L	Н	0	0				
· ·	•			03	30	°75	. 25	° 04	°004	
Figuring a 33 feet, t	ig an eff	Figuring an effective swath width of 33 feet, the following results were	n width of	ю	09	26.00	.26	1.59	.18	XXXXX
				4	06	27.5	.12	270	000	
1)° 6	acres co erage of	6 acres covered per minute. Average of 1.6 qts recovered	covered	വ	120	0 .8	.15	60°	600°	١
3). 34	per acre.	per more. 34 qts released per minute.	inute.	9	150	8.25	.15	.10	.01	
\$ ° (#	a.o que recovered.	coverede		7	180	6.5	.13	. 05	.005	
				ω	210	6.5	.10	.02	2000	
				0	240	0				
					Table 3k.					

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Temperature	68 F.	
e 50 ft.		•
Altitud		el oil
per hour		n #2 Dies
2-5 miles	ŗ	. 5% DDT in #2 Diesel
Wind Velocity 2-3 miles per hour		urvicide Used
Wind		Larvi
oss Wind		
Tight Cr		r hour
irplane PT-17 Direction Flight		90 miles per
PT-17		Speed
Airplane		Airplane

							DO III.								
Effective	Swath	Width	XXXX			XXXX	XXXX	XXXX	XXXX	XXXX	XXXX				
DDT	per	Acre	Soli			.25	. 49	.48	. 28	.11	•15	• 03	90*	90.	
Material	per	Acre	Qts	;		2,31	4.5	4.44	2.6	1.04	1.37	.30	• 58	61	
Average	Drop	Diameter	m/m		5	4.	4.	• 34	. 23	.17	•19	•14	•16	•15	
Number	Drops per	Sq. Inch			.	10	20	35	20	65	55	38	40	58	
Distance	from	Spray Track	Feet)	10	20	30	40	50	09	04.	80	06	100
Paper	Number	L		•	-1	N2	83	4	വ	9	7	ω.	0	10	11
Distance		Orifices	ed Inches		5	1+5	results		recovered	leased.					
Quarts			Discharged	8	94	4	of 60 feet, the following results		ll acres covered per minute. Average of 2.7 qts recovered	34 qts per minute released.	1000				
Size	of	Outlet Minute	Inches	L	0).	3	et, the		acres corrage of	54 qts per 1					
-	Number			C	77	9	of 60 feet, the		1). 11 2). Ave	3). 34 4) 20	•		•		

-19-

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			K	ESTR10	TED			
ft. Temperature 76 F.	Swath Width XXXX		XXXX		XXXX	<u>ي</u> و		
20	DDT per Acre	90.	. 52	.15	.13	.033	.01	
Wind Velocity 4 miles per hour Altitude 50 ft. Lervicide Used 5% DDT in #2 Diesel Oil	Material per Acre	0.05	4 K	2. 3.	2.24	10 C	-	
es per hour	Average Drop Diameter m/m	0 11.	22 23	89 7	.2	T -	60	
uty 4 mile	Number Drops per Sq. Inch	0 4%	110	110	85 85	85	3 04	
,	Distance from Spray Track Feet	10	20	9 9	90	70	8 06	100
oss Wind	Paper Number	ન જ	<i>w</i> ∫ 4	വ	9	ω σ) 01	п
Flight Cr	Distance between Orifices	80.	h width of ults were	inute.	eased.			
Airplane PT-17 Direction Flight Cross Wind Airplane Speed 90 miles per hour	Quarts per Minute	24	Figuring an effective swath width on 60 feet, the following results were obtained:	9 acres covered per minute. Average of 2.8 qts recovered	34 qts per minute released. 25 qts recovered.	,	,	
PT-17	Size of Outlet Inches	.75	g an eff , the fol	9 acres cov Average of	34 qts per minute 25 qts recovered.			
Airplan	Flight	13	Figuring an 60 feet, th obtained:	1). 9 E	3). 34			

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nre				ш	ب ك	REST	MIU		W					
Wind Velocity 5-6 miles per hour Altitude 50 ft. Temperature 80 F.		Effective Swath Width	XXXX		XXXX	XXXX	XXXX	XXX	XXXX					
nde 50	ł	DDT per Acre	Lbs	0	.23	. 45	.78	.23	• 15	.01	. 02	.017		
hour Altit	Diesel oil	Material per Acre	Qts	0	2.1	4.1	7.1	2.1	4.4	.1	α.	.16		
miles per	DDT in #2	Average Drop Diameter	m/m	0	. 4	• 25	. 31	.19	• 23		•11	r.		Parameter de la constant de la const
ocity 5-6	e Used 5%	Number Drops per Sq Inch		0	10	80	70	92	33	54	55	09		Sn
	Larvicide Used	Distance from Spray Track	Feet		10	20	30	40	50	09	70	. 80	06	Table Sn.
Cross Wind		Paper Number		p=-{	N	ĸ	4	C	ဗ	7	œ	6	10	
	per hour	Distance between Orifices	Inches	က		n width results	-	covered	ensed.		alfinorin resilience			
Direction	90 miles	Quarts per Minute	Discharged	. 34		Figuring an effective swath width of 50 feet, the following results were obtained:		Average of 3.3 qts recovered	per acre. 34 qts per minute released. 29,7 ots recovered.					
PT-17	Airplane Speed	Size of Outlet	Inches	•75		s an erre		rage of	per acre. 34 qts per 29.7 ots re	d D J			"	
Airplane	Airplane	Flight Number		14		Figuring an er of 50 feet, th	1	2). Ave	3). 34 4). 29.					

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Temperature 84 F.	Characteristic or other complete comple	Effective Swath Width	XXXX		XXXX	XXXX	XXXX	XXXX	XXXX			
50 ft.		per Sere	Lbs	.017	.16	. 26	. 46	.73	. 33	900*	900.	
Altitud	SSOL OLA	Material per Acre	Qts	91°	1,5	2°4	4.2	9.9	3.0	90.	90.	
ss per hour	5% DDT in #2 Diesel	Average Drop Diameter	m/m	ฉี	.26	22.	.19	ಬ	23.	.13	.15	
y 5-6 mile	ed 5% DD	Number Drops per Sq. Inch		rœ	25	09	180	250	70	œ	മ	30.
Wind Velocity 5-6 miles per hour Altitude 50 ft.	Larvicide Used	Distance Number from Drops per Spray Track Sq. Inch	Feet	20	10	0	10	20	30	40	20	Table 30.
Mind	pront.	Paper Number		2R	IR	0	11	217	31	41.	5L	
Flight Up	er heur	Distance between Orifices	Inches		24 to 22	results		minute.	eased.			
Airplane PT-17 Direction Flight Up Wind	Airplane Speed 90 miles per hour	Quarts per Minute	Discharged	34	The man of the continue of the	of 50 feet, the following results	,	7.5 acres covered per minute. Average of 3.5 qts recovered	Der acre. 34 qts per minute released.	•no Joa		
LT-Ld	Speed	Size of Outlet	Inches	°75		et, the	· novie	rage of	per acre.	opper so h	· ·	
Airplane	Airplane	Flight Size on Number Outlet		16	17 s	of 50 feet, the following	POT O TOM	1). 7.5 2). Ave	3). 34	19 • (#		

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Temperature	04	Effective Swath Width XXXX			XXXX	XXXXX	XXXX	XXXX	XXXXX			
1		DDT E S Acre W Lbs X	° 008	•032	.33	•68 X	• 44 ×	.33	.24 X	.018	• 002	-
tude 50 ft	ofl	Material per Acre	.07	. 29	2.0	6.2	4.0	3.0	2 2	.16	• 05	
nour Alti	5% DDT in #2 Diesel	Average Drop Diameter m/m	.10	21.	12.	.26	.21	.18	.18	.11	.11	
mile per	1	Number Drops per Sq. Inch	20	47	100	100	130	160	114	88	24	
Airplane PT-17 Direction Flight Up Wind Wind Velocity 1 mile per hour Altitude 50 ft.	Larvicide Used	Distance from Spray Track Feet	30	20	10	0	07	50	30	40	50	Table 3p.
Vind Wi	La	Paper	R3	R2	R1	0	ī	27	L3	1.4	LS	
Tight Up W	hour	Distance between Orifices Inches		14. 04. h	lts were	•	nute	eased.				
Direction F	Airplane Speed 90 miles per hour	Quarts per Winute	34	Rimming on offerting curth width of	50 feet, the following results were		y acres covered per minute. Average of 3.7 qts recovered	per acre. 34 qts per minute released.				
PT-17	Speed 9	110	.75	0.00	the fol		rage of	per acre. 34 qts per	35			
Airplane	Airplane	Flight Size of Number Outlet Inches	17	H. minely	50 feet,	obtained:	2). Ave	3). 34				

Temperature 60 F.		XXXX	XXXX	XXXX	XXXXX	XXXX						
ft,	DDT	Squ	.24	1,1	ಌ	. 22	90°	90.	000	.04	.03	
Altitude 50 Diesel oil	Material Per Acre	Qts	% %	10,1	1,9	2.0	. 58	. 58	. 48	.41	.30	
in #2 Die	Average Drop Diameter	m/m	. 26	.35	. 25	.25	.16	.17	.16	.16	ಌ	
Cross Wind Velocity 1 mile per hour Altitude 50 ft. Larvicide Used 5% DDT in #2 Diesel oil	Number Drops per Sq. Inch	0	81	70	34	32	40	31	23	20	11	
Wind Veloci	Distance from Spray Track	Feet	10	50	30	40	50	09	02	80	06	The state of the s
ss Wind	Paper N mber			83	10	4	ಬ	9	7	. ω	6	
	Distance between Orifices	Inches 3		ults were	/ 4	minute.	eased.					
Airplane PT-17 Direction Flight Airplane Speed 90 miles per hour	Quarts per Minute	Discharged 34		Figuring an effective swath width of 40 feet, the following results were obtained:	•	Average of 4 qts recovered per	34 qts per minute released.	vereu.	•			
Airplane PT-17 Direction Airplane Speed 90 miles	Size of Outlet	Inches °75		the fol		rage of	qts per	on des recovered.				
Airplane Airplane	Flight	18	•	40 feet,		1)° 7°5 2)° Ave	OS .	₹/° aO				

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Page 25 missing

Pilot Comments: The 225 horsepower Continental engine is capable of carrying the load with sufficient reserve to meet emergencies encountered in low level flying such as obstacles requiring quick pullups. The original propeller was flattened one degree to allow the use of a higher r.p.m. which facilitates take-offs and pull-ups.

There is no noticeable change in the attitude of the plane when flying with the tank empty, but when loaded with oil, which adds about 425 pounds weight, it is necessary to use about four degrees trim tab on the elevator.

The tank was constructed without baffles. The pilot has noticed that the unobstructed flow of oil and the quick shifts of its weight during turns causes sudden changes in the attitude of the plane and thinks that baffles in the tank which would greatly retard changes in the position of the liquid would add greatly to the maneuverability.

The PT-17 (Stearman), with regular maintenance, requires no more mechanical attention for the work of the larvicidal oil spraying than for the purpose for which it was built, that of training flying students; it used 80 octane gasoline, which is generally available, and its gas consumption is such as to give good economy of operation for the load carried. The PT-17 can be flown from small and improvised landing fields, and the excellent visibility and maneuverability fully meet the requirements of low level flying.

Figures 2 and 3 show the airplane at work spraying canals in the Leghorn area. Notice that the altitude at which the plane can be flown makes careful placement of the spray possible. Figures 3a and 3b show the discharge apparatus.



Figure 2. The PT-17 (Stearman) airplane spraying a canal with DDT in oil; notice the stream of spray dropping directly into the canal.



Figure 3. The PT-17 (Stearman) oiling airplane flying down a large canal in the Leghorn area; the widening stream of spray fog can be seen flowing past the under surface of the tail.





Figure 3a. Front view of oil discharge apparatus (PT-17) showing adjustable Venturi sleeve.



Figure 3b. Side view of oil discharge apparatus (PT-17) showing adjustable Venturi sleeve.



III. OIL SPRAYING APPARATUS FOR THE AIRPLANE, A-20, U.S. A. A.F.

The position of the tank and the oil spraying apparatus in the A-20 airplane and detailed drawings of the valve and atomizing apparatus are shown in Figure 4. As shown in the drawing, the tank is mounted at the bottom of the bomb bays.

Modifications of the reservoir tank: The shape and dimensions of the reservoir tank used in the A-20 airplane are shown in Figures 5 and 6 which illustrates the plans for the tanks mounted in the airplanes in the spring and prior to the tests leading to the modifications shown in Figure 4 and described below.

The filler pipe was extended upwards from the top of the tank and curved toward the right side of the airplane and connected to an opening through the side of the fuselage, at a point about 2/3 of the distance above the bottom, into which the filler cap had been mounted. Thereby, the tank may be filled through an external opening which may be reached from the ground, and spilling of oil inside the airplane due to carelessness is minimized.

Since there are transverse reinforcements of the bomb bays, a constriction had to be built in the tank at about the midpoint of its length in order to fit it into the bomb bay; this constriction, in effect, divides the vessel into two compartments. During filling, the filler tube acts as an air vent for the forward compartment of the container, but a vent had to be provided for the rear compartment. This was done by extending a 1 1/4 inch line from the top of the tank to the top of the bomb bay; an air tight valve is opened allowing air to escape, but when the tank is full, the valve is closed manually.

The fluid sealed air vent, described in the introduction, was introduced into the rear compartment of the tank; its position is shown in Figure 4.

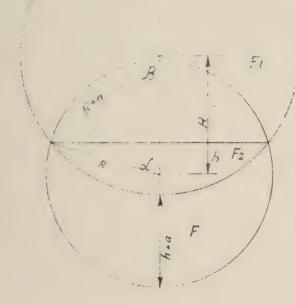
Valve: A three inch gate type valve was placed in the discharge line at its connection to the tank. An A-20 Cowl Flap Actuating Cylinder (hydraulic) was used as the mechanism to open and close the valve; the control lever for hydraulic pressure was put in the pilot's cockpit.

Control of the rate at which the liquid is released from the tank by the extent to which the valve was opened was tried. For this purpose it was desired to open the valve to expose a surface area the equivalent of that of a pipe one inch in diameter, two inches in diameter, etc. The valve was calibrated according to the calculations shown in Plate 1; the calibrations are shown in the form of a curve in Figure 7. Setting of the valve for a given surface area was obtained by putting an adjust-



 $I = 2R \sin \lambda = 2(R+a) \sin \beta t$ $H = (R+a) \cos \beta = R \cos \beta$

H = 2 (V4/140)2-12 IV412-62



$$F = \frac{1}{2} R^{2} (2d + \sin 2d)$$

$$b = 2R \sin d$$

$$FI = \frac{1}{2} R^{2} (2 \cos \sin 2\pi - 2 \frac{1}{2} R V I - (\frac{1}{2} R)^{2})$$

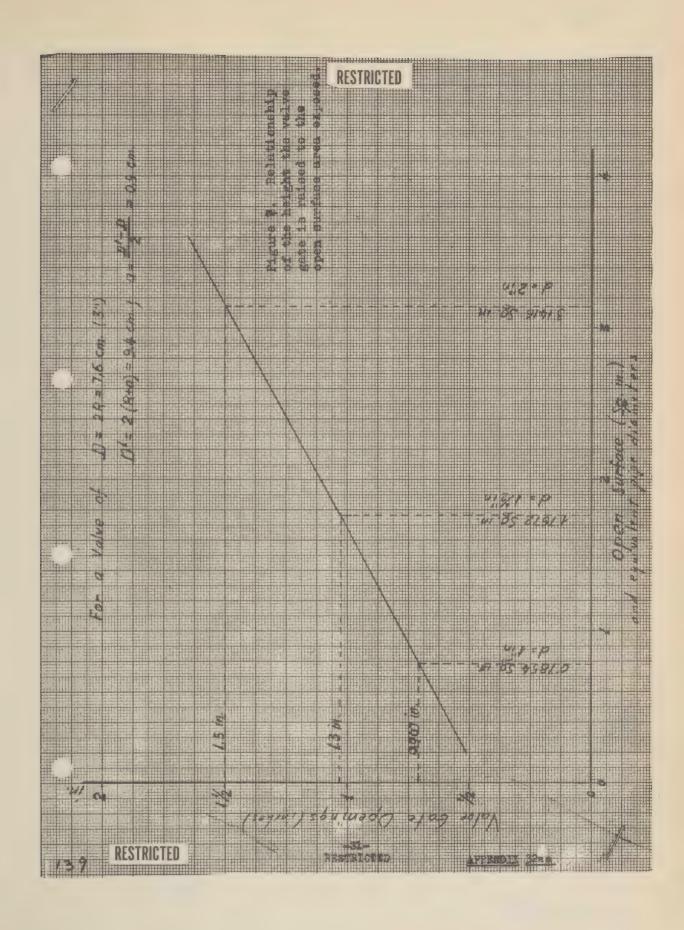
$$FI = R^{2} (arc \sin 2\pi - \frac{1}{2} R V I + (\frac{1}{2} R)^{2})$$

$$F2 = (R + a)^{2} (arc \sin 2(Ra) - \frac{1}{2} Ra) V I - (\frac{1}{2} Ra)^{2})$$

$$H > 1069$$
 $F = \pi R^2 - F_1 - F_2$
 $H = 1069$ $= F_1 = 123 3 3 2 - F_2 - \dots$
 $= 1069$ $= F_1 - F_2$

PIATE I. Reference diagram of gate valve mechanism and calculations used to determine the surface area of the opening emposed as the gate valve is lifted.







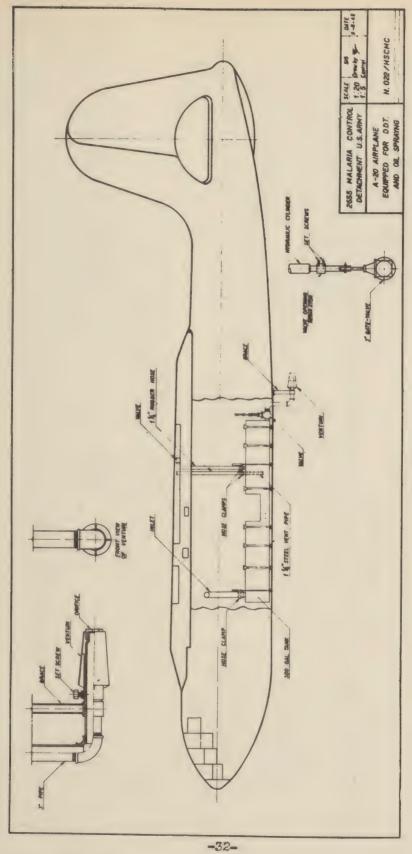
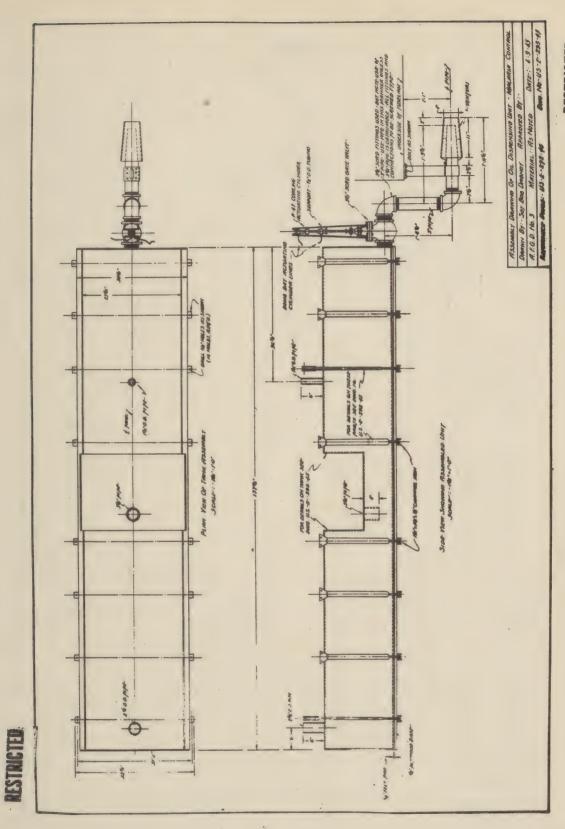


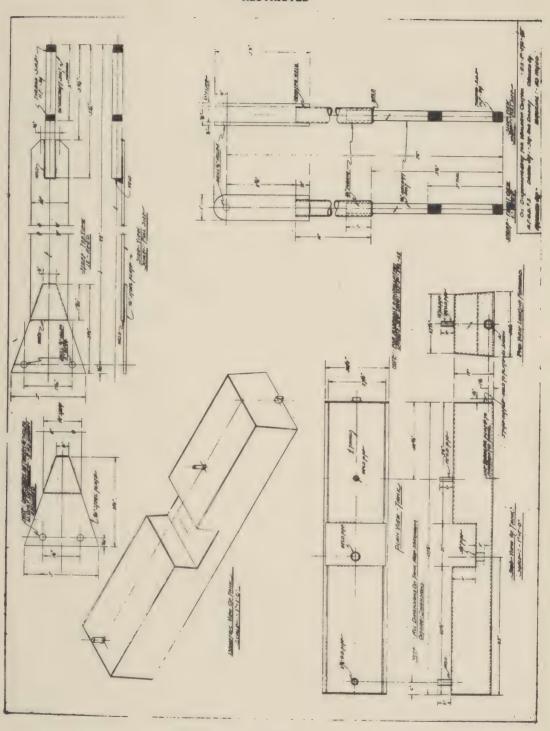
Figure 4.

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able shoulder type stop on the stem of the hydraulic actuating cylinder; set screws held the stop fixed in the setting desired. Thus the hydraulic cylinder raised the gate of the valve the distance allowed by the stop. The position of the shoulder type stop with relation to the valve and the hydraulic actuating cylinder is shown in Figure 4.

It was found however, that when the terminal orifice of the pipe was larger than the opening of the valve, the liquid did not flow out of the pipe evenly but spurted and bubbled. This bubbling was checked by putting a washer having an inner circle of the desired diameter in the discharge orifice; the washer was held in place by a screw cap on the end of the pipe. The diameter of the discharge orifice could be changed by the use of washers with inner circles of different diameters. The valve was then set to correspond with the diameter of opening used at the end of the pipe.

Atomizing apparatus: The atomizer is essentially the same as that previously described for the PT-17 airplane and consists of a truncated cone six inches in diameter at its open base and four inches in diameter at its top. It was mounted over the pipe with its long axis parallel to the pipe. The cone may be moved forwards or backwards along the pipe, but is held in place at any desired setting by a set screw.

Figures 11, 12, 13, 14, 15, 16, and 17 show the airplane at work in the Pisa area.





Figure 11. Loading an A-20 with larvicide by means of a small gasoline engine driven rotary pump.



Figure 12. A-20 demonstrating oil larviciding over Pisa-Leghorn barge canal. (Note oil-discharge pipe)





Figure 13. A-20 demonstrating oil larviciding margins of Pisa-Leghorn barge canal. (Elevation of plane approximately 25 feet).



Figure 14. A-20 discharging 5% DDT in Diesel Oil Larvicide on small canal near Pisa, Italy. (Elevation of plane approximately 35 feet).





Figure 15. A-20 discharging 5% DDT in Diesel Oil Larvicide on small canal near Pisa, Italy. (Elevation of plane approximately 50 feet.



Figure 16. A-20 demonstrating oil larviciding over field near Pisa, Italy. (Elevation of plane approximately 35 feet).





Figure 17. Venturi sleeve on A-20 oiler (rear view showing discharge pipe within sleeve).



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Performance

Determination of rate of discharge: When the reservoir had been equipped with the fluid sealed air vent to balance the effect of static head pressure, a sight gauge calibrated in gallons for the capacity of the tank was mounted externally to the tank in such a position that a person riding in the rear or tail gunner's cockpit could read the gauge. Test flights were then made to determine the rate of discharge; an observer riding in the rear cockpit read the gauge and recorded the gallons flowing out of the tank each minute from the time the valve was opened until the tank was empty. These flights showed that the liquid flowed out of the tank at an even uniform rate throughout the period the container was emptying; results of various flights are shown in Table 4.

Table 4. The effect of various valve openings and diameters of the terminal discharge orifice on the rate of discharge in gallons per minute; the total time required for the 300 gallon tank to empty and linear distance covered during that period with the A-20 airplane flying 3.3 miles per minute.

Number of Trials	Valve Opening (inches)	Diameter Terminal Orifice (inches)	Rate of Discharge (gals/min)	Total Time Required to Empty Tank (minutes)	Linear Spray Track Covered (miles)
7	.71	1	21.5	14.0	46.2
10	1.03	1 1/2	40.0	7.5	24.7
5	1.5	2	66.0	4.5	13.2

Coverage: Determination of coverage of sprayed surface was done according to the manner and methods already described for the PT-17 (Stearman).

The results of the spray trials with the A-20 are summarized in Table 5 and are presented in greater detail in the tables following it which show the data for each individual flight.



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The effect of change in temperature and variation of the distance between the orifices of the atomizer of the oil spraying apparatus for an A-20 airplane on the width of the spray swath and amount recovered of No. 2 Diesel oil released at a height of 50 feet from an airplane flying cross wind. Table

Average	(qts/acre)	~ o	80°8	20,03	100 age cor	8 8	ເລ	2 %	2°6	83	8 1	P 8 8		
Fercent Effective Lost Swath Width	(feet)	09	100	160	none	none	140	160	80	20	none	none		
	And the state of t	20%	2%	2%	95%	85%	8%	30%	62%	84%	92%	92%	O CONTROL OF	
Quarts Recovered per min	State State Management Confidence of Applications of Applicati	42.0	152.0	152.0	6.88	23.86	150.0	145.0	100.0	42.0	21.32	20.39		
Quarts Released per min.	Designation of the contract of	98	160	160	160	160	160	160	264	264	264	264		
Temper- ature	(Fahr)	88	29	29	80	86	09	80	94	94	96	86		Table 5.
Average Drop Diameter	(MM)		6	8	0.14	.16	, 16	210	91.	, 15	.19	.18		
Range of Average Drop Diameters	(um)	011-024	.1822	.12-,23	.1224	.1329	.1320	.1519	.1030	.1029	.1239	.1427		
Distance between Orifices	(Inches)	1°0	Flush	7°2	1,5	٦٠٤	4.0	4.0	2°0	3.0	4.0	5.0		
Size of Outlet	(Inches)	1,0	1,5	1,5	1,5	1.5	1,5	1,5	2°0	2.0	2.0	2°0		
Flight		4	12	H	23	છ	10	13	9	_	œ	O		

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			Comparative in the contract of							
Flight	Size of Outlet	Quarts per Minute	Distance between Orifices	Paper		Number Drops per Sa. Inch	Average Drop Diameter	Material	DOLL	Effective Swath Width
	Inches	000	Inches		Feet		mm	Qts	Lbs	XXXXX
proof.	Luci, CO	160	ro 	6R	150	4			(D-Allinosa)osaposapi	
	9		1 40 40	5R	120	4.5	770	* 0°	° 004	
of 50 feet, th	et, the	of 50 feet, the following results	results	43	06	0	010	910	0.02	
acro o row	e north			3R	09	20.0	270	. 34	0.04	
1). 20 a	acres co	20 acres covered per minute. Average of 7.1 qts recovered	minute.	22	30	80.0	800	8 0	.24	XXXX
3)。	per acre.	per acre. 160 qts per minute released.	leased.	Ħ	72	250.0	720	8.7	688	XXXX
4), 142 5), 12%	142 qts recovered. 12% lost by evapor	142 qts recovered. 12% lost by evaporation.	ono	Н	0	120.0	80		1.27	XXXX
0	vae were	Larvae were killed in a 60 foot swath on this run. I	ne 60	님	13	. Q.	S		000	
larvae	vae were	larvae were in dishes 15 feet apart.	15 feet	2L	30	1,0	89	60°	600°	
				3L	09	0.0				

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er	.4 60	Effective Swath Width	XXXX												
50 ft.		DDT Fer Short	Lbs				600	• 04	• 004	.002	• 004	.001	• 003	2000	-
Altitude	Diesel oil	Material per Acre	Qts				*00	•34	•04	*00	•04	10.	• 03	900*	
s per hour	5% DDT in #2 Di	Average Drop Diameter	mm			0	.135	*24	•126	.12	.123	.125	.123	.128	
ty 2 miles		Number Drops per Sq. Inch				0	7.5	7.25	4.5	4.0	6.5	1.75	5.25	1.25	
Wind Velocity 2 miles per hour Altitude 50 ft.	Larvicide Used	Distance from Spray Track	Feet	0	30	09	06	120	150	180	210	240	270	300	Table 5b.
Cross Wind		Paper		m	ಬ	ಣ	₹	ດ	9	7	Ø	6	10	11	
- 1	per hour	Distance between Orifices	Inches	1.5	,	oration.			,						
Airplane A-20 Direction Flight	Airplane Speed 200 miles per hour	Quarts per Minute	Discharged	160		Effectiveness lost by evaporation.									
A-20 I	Speed	Size of Outlet	Inches	1,5		reness lo									
Airplane	Airplane	Flight		N		Effectiv									

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Temper	SO F.	Effective Swath Width	XXXX	^					÷								
50 ft.		DDT per Acre	Lbs	ing			80.	. 00	• 05	*008	.007	.01	•01	.01	.01	• 008	
Altitude 50	Diesel oil	Material Per Acre	Qts	1			. 80	• 64	. 41	80.	07	.13	11.	.11	.11	.08	
s per hour	in #2	Average Drop Diameter	mm				.29	.21	81.	.13	.13	.13	•14	.14	.14	*13	
ty 2 mile	Jsed 5% DDT	Number Drops per Sq. Inch		0	0	0	00.	20.0	20.5	11.0	9.25	16.75	12.0	12.0	12.0	11.5	0.0
Wind Velocity 2 miles	Larvicide Used 5%	Distance from Spray Track	Feet	0	30	09	06	120	150	180	210	240	270	300	330	330	Table 5c.
ss Wind		Paper Number		Н	લ	62	4	ري ما	w	7	œ	Ø	10	11	12	13	
light Cro	per hour	Distance between Orifices	Inches	1,5													manufacturation of transfer and
Direction Flight Cross	200 miles per hour	Quarts per Winute	Discharged	160	4	Ellectiveness lost que vo evaporation.											
	Speed	Size of Outlet	Inches	٦, 5		reness 1		,									
Airplane A-20	Airplane Speed	Flight		89		Ellectivenes evaporation.											

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Temperature		Effective Swath Width	XXXX			XXXX	XXXX	XXXX			*****			
50 ft.		DDT per Acre	Lbs		.003	.13	۲.	.12	90.	.015	600.	900°	.002	
Altitude	sel oil	Material per Acre	Qts		.03	2°5	6.	1.1	• 5	•14	*08	• 05	.02	
per hour	in #2 Diesel	Average Drop Diameter	TIMIL		.13	•24	.215	.24	8.	•14	.11	.13	.125	
7 2 miles	ed 5% DDT	Number Drops per Sq. Inch			4	24.5	25.0	22.5	19.0	14.5	9.5	7.0	3.0	5d.
Up Wind Wind Velocity 2 miles per hour Altitude 50 ft.	Larvicide Used	Distance from Spray Track	Feet	120	06	09	30	15	0	15	30	09	06	Table
Wind	1	Paper Number		5R	4R	338	2R	1R	1	11	2L	3L	4	
	per hour	Distance between Orifices	ed Inches			th width results	minnte	ecovered	leased.	ion.				
Airplane A-20 Direction Flight	Airplane Speed 200 miles per hour	Quarts per Minute	Discharged	98		Figuring-an effective swath width of 90 feet, the following results were obtained:	38 seres covered ner minute.	Average of 1.1 qts recovered	per acre. 86 qts per minute released.	Lost 50% by evaporation.				
A-20	Speed	Size of Outlet	Inches	-		set, the	0 80108	rage of	per acre. 86 qts per	Lost 50% by evapo				
Airplane	Airplane	Flight		4		Figuring-an ef of 90 feet, th were obtained:	1). 38	2). Ave	3). 86	• •				

-45-

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ure 90 F.		ive		1 L5 C	RESTR	icied								
Temperature		Effective Swath Width XXXXX		• .	3	XXXX XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX		
fto		DDT Per Acre Lbs			20.	.15	.43	. 45	. 32	۲.	4	• 14		
Altitude 50	el oil	Material per Acre Qts			71.	1.4	3°9	4.1	5.0	0,	0,	I. S		
9	in #2 Diesel	Average Drop Diameter			. 14	0 80	.26	.28	. 26	. 26	.31	හ දැ •	RS	
3 miles p	5% DDT	Number Drops per Sq. Inch			18,25		64.0	54.0	48.0	14.5	8 2	16.75	NO PAPERS	5e.
Wind Velocity 3 miles per hour	Larvicide Used	Distance from Spray Track Feet	150	06	09 2	15	0	15	30	09	06	120	150	Table
Wind Wi	I.e.	Paper	GR.	4	3R	IR 1	H	11	72	3L	41.	2T	79	
	er hour	Distance between Orifices Inches	ત્ય	th width	soverede	scovered eleased.	lon.							
Airplane A-20 Direction Flight UP	Airplane Speed 200 miles per hour	Quarts per Minute	264	Figuring an effective swath width of 180 feet, the following results were obtained:	73 acres per minute covered.	Average of 4.2 qus recovered per acre. 264 qts per minute released.	qts recovered. lost by evaporation.							
e A-20 I	e Speed 2	Size of Outlet Inches	လ	Figuring an offe of 180 feet, the were obtained:	acres pe	Average of per acre. 264 qts per	160 qts recovered. 40% lost by evapor							
Airplan	Airplan	Flight Number	က	Figurin of 180 were ob	1). 73	• •	4). 16 5). 40							

-46-

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Airplan	e A-20	in co	Flight Cros	ss Wind		ty 4 miles	per hour	Altitude	50 ft.	Temperature 94 F.
Airplan	Airplane Speed	200 miles per hour	per hour	,	Larvicide Used	5%	DDT in #2 Die	Diesel oil		
Flight	Size of Outlet		Distance between	Paper Number	Distance from	Number Drops per	Average Drop	Material	-	Effective Swath
	Inches	Minute U	Orifices ed Inches		Spray Track Feet	og. Inch	Diameter mmm	Acre	Acre	Width
ဖ	cs.	264	ત	Н	0	0	0			
	,			03	30	25	83	2.28	.25	XXXX
Figurin of 90 f	g an effect, the	Figuring an effective swath width of 90 feet, the following results	th width results	ಣ	09	54	.28	4.1	. 45	XXXX
0	were obtained:	•		4	06	40.75	.22	1.5	.165	XXXX
1). 58 2). Av	acres rerese	Average of 26 qts recovered.	covered.	ಬ	120	8.0	.21	•26	• 029	
	per acre. 264 qts re	264 qts released per minute.	minute.	9	150	8.0	.14	.07	• 008	
4). 10 5). 62	0 qts re % lost b	100 qts recovered. 62% lost by evaporation.	ion.	7	180	6.75	.1	• 024	.0026	
				∞	210	5.0	۲.	.02	-002	
				6	240	4.5	.11	.02	- 002	
				10	270	4.0	.11	•014	- 002	
				11	300	5.0	.12	.02	.002	
				12	330	5.0		.02	-005	
				13	360	NO PAPERS	80			
					Table 5f.					

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Temperature		Effective Swath	Width		,		XXXX							,			
ft.		DDT	Acre		*		• 35	• 04	.01	20.	*008	.01	• 008	• 008	600		
Altitude 50	el oil	Material	Acre		2	, .	200	\$2. 45.	.10	.17	.07	.12	80°	*08	60		
per hour A	in #2 Diesel	Average Drop	Diameter		A 401.7 s	114 *	.29	.15	.14	.18	.12	.14	.12	•10	.12		
	Used 5% DDT	Number Drops per	Sq. Inch.	4.	and entered	V	(W	29	a a	8.25	12	12.2	14	24	14.5	NO PAPERS	
Wind Velocity 4 miles	Larvicide Us	Distance	Spray Track	.0	30		06	120	150	180	210	240	270	200	230	360	Table 5g.
s Wind	general of the state of	Paper Number		H	જ	. 10	4	۵.	ွ	7	00	o	10	11	12	13	
Direction Flight Cross	per hour	Distance	Orifices d Inches	to.		Figuring an effective swath width of 30 feet, the following results were		minute.	minute.	ion.			a v				
Direction	200 miles	Quarts	Minute Discharged	264	,	Figuring an effective swath width 30 feet, the following results we	obtained:	13 acres covered per minute. Average of 3.2 qts recovered	per acre. 264 qts released per minute.	42 qts recovered. 84% lost by evaporation.						.**	
3 A-20	Airplane Speed	Size of Outlet	Inches	2		g an eff		acres c	per acre. 264 qts re	42 qts recovered. 84% lost by evapo							
Airplane A-20	Airplane	Flight		7		Figuring 30 feet,	obtained	1), 13 2), Ave	•	4). 42 5). 84%			. •				

-48-

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						find?		ین صوبی	Spanned 6									
2	900	Effective Swath Width	YYYY															
fto	1	DDT per Acre	202				900°	•010	.032	60°	.03	600	.007	.003	.003	900*	.003	
Altitude 50	el oil	Material per Acre	&ts				• 05	.17	. 29	.81	. 28	80.	90.	.03	.03	• 05	.03	en e
1	in #2 Diesel	Average Drop Diameter	mm				O. 10	.29	.24	.22	.18	. 15	.12	.12	.12	.123	.125	
4 miles pe	5% DDT	Number Drops per Sq. Inch		0	0	0	. 23	2.00	6.25	22.00	14.00	8.00	10.00	4.5°	4.5	8.0	4.5	
Wind Velocity 4 miles per hour	Larvicide Used	Distance from Spray Track	FOOT	0	30	09	06	120	150	180	210	240	270	300	330	360	390	Table 5h.
s Wind		Paper Number			N	80	4	ر ما ا	9	7	ø	O	10	11	12	13	14	
light Cros	per hour		d Inches	4	red with	een orif-	mperature	by evapor										
Direction Flight Cross		Quarts per Minute	Ulscharged Inches	264	inely atom	the Venturi set at 4" between orif-	reached the ground in a temperature	All the effectiveness lost by evapor-										
	Airplane Speed 200 miles	Size of Outlet	Tuches	~	WAS SO F	turi set	the grou	effectiv										
Airplane A-20	Airplan	Flight Number		ω	The oil	the Ven	reached '	All the	actom.									

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					Li ind		RE	STRI	CTEI) " "									
0	98 F.	Effective Swath Width	XXXXX														\$ 1 1 + 15,		
Pt.	The second control of	DDT. Per Acre	Lbs			. 03	0.04	• 004	.02	.024	.019	.013	0.012	.017	.013	.008	900°		
Altitude 50	el 011	Material per Acre	Qts			. 62°	. 325	.04	.15	. 22	. 17	.12		.16	.12	.07	.05		
per hour A	in #2 Diesel	Average Drop Diameter	mm	4,7%		.27	.21	• 14	. 180	.185	.188	.175	.178	. 18	.178	.17	.17	Ø	
miles	5% DDT	Number Drops per		escationamenty co	0	3,75	10.0	4.0	7.5	9.25	7.0	5.0		8 0 8	0.9	4.25	3,25	NO PAPERS	
Wind Velocity 4	Larvicide Used	Distance from Spray Track			20	09	06	120	150	180	210	240	270	200	330	360	390		Table 51.
Wind		Paper		-	2	80	4	വ	9	7	00	0	10	11	12	13	14	15	
Flight Cross	per hour	Distance between Orifices	Inches	ശ	-	between	perature	vaporation				oteradores con calquinola	Provinces and an extension of						
Direction Fl		Quarts per	rge	264		with the Venturi set at 4" between	reached the ground in a temperature	All effectiveness lost by evaporation.											
	Airplane Speed 200 miles	Size of Outlet	Inches	ಣ		was so I	the grou	ectivenes					,						
Airplane A-20	Airplan	Flight		6	Ē	with th	reached	All eff											

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R	F	8	77	[8]	- Comment	119	7	15	
Brak Irea	Bassoni	Name of Street	Book	Bear ro-9	4.00	1 400	1.00		
			RES						

Airplan	peeds e	Airplane Speed 200 miles per hour	r hour	I	Larvicide Used	5% DDT	in #2 Diesel	l oil		00 1:
Flight	Size of Outlet	Quarts per Minute	Distance between Orifices	Paper Number	Distance from Spray Track	Number Drops per Sq. Inch	Average Drop Diameter	Material per Acre	DDT per Acre	Effective Swath Width
	Inches	Discharged	Inches		Feet		mm	Qts	Libs	XXXX
10	1,5	160	4	4	30	172	. 14	1.9	ೲ	XXXX
F	o		-	ഹ	40	110	.16	3°2	83 83	XXXX
of 140	of 140 feet, the	of 140 feet, the following results	wiath esults	9	09	105	N,	8 . 8	.31	XXXX
no e rew	·namman	1		4	80	191	.17	8.8	. 42	XXXX
1). 60 2). Av	erage of	60 acres covered per minute. Average of 2.5 qts recovered	inute.	Ø	100	176	.18	က	.39	XXXX
	per acre. 160 qts rel	160 qts released per minute.	nute.	0	120	136	.14	1.3	.14	XXXX
5) . 6%	6% lost by evapora	6% lost by evaporation.		10	140	134	91.	1.9	, N3	XXXX
				더	160	100	.16	1.4	e Ci	XXXX
				12	180	75	.14	ω.	.088	
				13	200	56	.13	េំ	.055	
					Table 51.					

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				U	16	U RI	ESTR:	CTE	D E											
Temperature	0.7	Effective Swath Width	XXXX	XXXXXX	XXXXXX	XXXXXX	XXXXX	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	٠, ٠		
fte		DDT per Acre	.050	014	660°	0110	.198	.220	.220	.297	.374	.374	.352	.319	. 462	.264	.110	690°		
Altitude 50	l oil	Material per Acre	Qts 0.45	6 0	/, 6°0	1.00	800	2°0	2.0	2.7	3.4	3.4	83 .23	6.8	4.2	2.4	1.0	, 63		
per hour A	in #2 Diesel	Average Drop Diameter	. 12	7H.	0.16	,16	.18	.18	.17	.18	23	2.	0.10	.19	.23	83	•14	.13		
miles	5% DDT	Number Drops per Sq. Inch	74	74	29	70	06	100	120	136	127	126	134	120	100	06	. 001	85	0	
Wind Velocity 1-2	Larvicide Used	ack	Peec.	10	0	10	20	30	40	50	09	70	80	06	100	120	140	160	. Table 5k	
Wind	200 miles per hour	per hour	Paper	2L	디	0	1R	2R	3R	4R	5R	6R	TR	8R	9R	10R	11R	12R	13R	
Tight Cros			000	Inches 1.5		h width	results	minute.	covered	Leasedo	Ţ,									
Direction Flight Cross			200 miles	Quarts per Minute	Discharged - 160		Figuring an effective swath width of 160 feet, the following results were obtained:	de acres covered per minute. Average of 2.3 qts recovered per acre. 160 qts per minute released. 152 qts recovered. 5% lost by evaporation.												
A=20	Speed	Size of Outlet	Inches	lacion .	g an eff	reet, th	acres c	Average of per acre.	O qts pe.	Lost by										
Airplane	Airplane Speed	Flight Number			Figurin	were obtained:	1), 66	0		2).										

N	15	S	RES	TRI	CTED		E	
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				M	50	RES	TRIC	red .			
Temperature	. 1	Effective Swath Width	XXXX		XXXX	XXXX	XXXX	XXXX	XXXX		
10 ft.		1 DDT per Acre	Tps	.055	. 385	. 55	. 583	.341	.264	.055	
titude 5	oil	Material per Acre	Qts	e S	3,5	5.0	5.3	3.1	2.4	ດ	
per hour Al		Average Drop Diameter	mm	. 22	16.0	.18	•19	ೲ	.19	6 r •	
2-3 miles	5% DDT i	Number Drops per		13	250	250	230	116	100	61	51.
Airplane A-20 Direction Flight Cross Wind Wind Velocity 2-3 miles per hour Altitude 50 ft. Persture	Larvicide Used 5% DDT in #2 Diesel	Distance from Spray Track	Feet	20	30	50	70	06	110	130	Table 5
Wind Wi	i i	Paper Number		7	23	က	4	2	9	7	
ght Cross	r hour	Distance between Orifices	Inches	. 0	width of		nute.	3 7	9000		
irection Fli	Airplane Speed 200 miles per hour	Quarts per Minute	Discharged	160	Figuring an effective swath width of	Ser Sire	40 acres covered per minute.	per acre.	152 qts recovered.		
A-20 D	Speed	Size of Outlet	Inches	1.5	san effe	1:	acres co	acre.	152 qts rec	201	
Airplane	Airplane	Flight Size of Number Outlet		12	Figuring	obtained:	1) • · 40		4). 152 (A) 152		

RE	87		U (G	-	5	
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Fight 51ze of Quarts Distance Paper Distance Number Number Cross Conference Number Cross Conference Cross Conference Cross Cross	Airplane Speed	peed	COO MILES De	ber pour	•		3/0 0/01	THE PLASET	770 70		
Outlet per between Number from Spray Track Trops per Drops per Agree Agree Agree Agree Agree Agree Agree Agree Agree Agree Agree	1	Size of		Distance	Paper	Distance	Number	Average	Material	DDT	Effective
2 20 270 .15 3.0 .33 3 40 220 .17 3.7 .407 4 60 213 .16 2.9 .319 4 60 213 .16 2.9 .319 5 80 140 .16 2.0 .22 6 100 104 .16 1.8 .198 8 140 72 .16 1.8 .198 9 160 60 .16 .8 .088 10 180 60 .16 .8 .088 11 200 21 .17 .4 .044 12 210 5 16.0 .07 .077		Outlet		between Orifices	Number	from Spray Track	Drops per	Drop	per	per	
2 20 270 .15 3.0 .33 3 40 220 .17 3.7 .407 4 60 213 .16 2.9 .319 5 80 140 .16 2.0 .22 6 100 104 .16 1.05 .165 8 140 72 .16 .16 .16 .16 .16 .16 10 180 60 .16		Inches	-	Inches		Feet	2 2	uuu	Qts	Lbs	
an effective swath width city. the following results 3 40 220 .16 3.7 .407 cres covered per minute. age of 2.2 qts recovered per minute released. 5 80 140 .16 2.0 .22 qts per minute released. qts recovered. 6 100 104 .16 1.5 .165 qts recovered. 7 120 75 .19 1.8 .198 qts recovered. 8 140 72 .16 1.0 .11 lost by evaporation. 8 160 60 .19 1.5 .165 10 180 60 .16 .8 .088 11 200 21 .17 .4 .044 12 210 5 16.0 .07 .077 .077	13	L S	160	. ♣ ,	23	20	270	.15	0°0	. 33	XXXX
4 60 213 .16 2.9 .319 5 80 140 .16 2.0 .22 6 100 104 .16 1.5 .165 7 120 75 .19 1.8 .198 8 140 72 .16 1.0 .11 9 160 60 .19 1.5 .165 10 180 60 .16 .8 .088 11 200 21 .17 .4 .044 12 210 5 16.0 .07 .077	,				23	40	220	0.17	3.7	.407	XXXX
covered per minute. 5 80 140 .16 2.0 .22 f 2.2 qts recovered 6 100 104 .16 1.5 .165 er minute released. 7 120 75 .19 1.8 .198 ecovered. 8 140 72 .16 1.0 .11 by evaporation. 8 140 72 .16 1.0 .11 by evaporation. 9 160 60 .19 1.5 .165 10 180 60 .16 .8 .088 11 200 21 .17 .4 .044 12 210 5 16.0 .07 .077	uring 160 f	an effe	sctive swath	width	4	09	213	,16	o. %	.319	XXXX
cress covered per minute. 6 100 104 .16 1.5 .165 age of 2.2 qts recovered 6 120 75 .19 1.8 .198 qts per minute released. 7 120 72 .16 1.8 .19 qts recovered. 8 140 72 .16 1.0 .11 lost by evaporation. 9 160 60 .19 1.5 .165 10 180 60 .16 .8 .088 11 200 21 .17 .4 .044 12 210 5 16.0 .07 .077	e opt	ained:			2	80	140	.16	2°0	.22	XXXX
acre. 4cre. 120 75 .19 1.8 .198 qts per minute released. 8 140 72 .16 1.0 .11 lost by evaporation. 9 160 60 .19 1.5 .165 10 180 60 .16 .8 .088 11 200 21 .17 .4 .044 12 210 5 16.0 .07 .077	60 Aver	acres co	2.2 qts reco	nute.	9	100	104	.16	1,5	.165	XXXX
qts recovered. 8 140 72 .16 1.0 .11 lost by evaporation. 9 160 60 .19 1.5 .165 10 180 60 .16 .8 .088 11 200 21 .17 .4 .044 12 210 5 16.0 .07 .077	per 160	acre.	minute rele	esed.	7	120	75	.19	1.8	.198	XXXX
160 60 .19 1.5 .165 180 60 .16 .8 .088 200 21 .17 .4 .044 210 5 16.0 .07 .077	145	qts reclost by	covered.	•	ω	140	72	.16	1.0	.11	XXXXX
180 60 .16 .8 200 21 .17 .4 210 5 16.0 .07		-			o	160	09	67.	1.5	.165	XXXX
200 21 .17 .4 210 5 16.0 .07					10	180	09	.16	Φ.	.088	
210 6 16.0 .07					11	200	21	.17	4.	.044	
					12	210	ည	16.0	.00	.077	

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IV. DISCUSSION.

Temperature: Very little oil is lost by evaporation at a temperature of less than 80 F. while more than half of the oil is lost at temperatures above 90 F.

Atomization: Smaller and more uniform size drops are produced when the distance between the orifices on the Venturi is increased.

Wind Velocity: The oil is most effectively applied at a wind velocity of less than 5 m.p.h.

<u>Drift:</u> With a wind velocity of 4 m.p.h. flying cross wind at an altitude of 50 feet the drift down wind is approximately 30 feet. Flying under the same conditions at an altitude of 100 feet, the drift is about doubled.

Altitude: Apparently the effective swath width is not changed appreciably (eliminating the factor of evaporation) with altitudes above 50 feet. However, the drift is increased.

Effective Swath Width: The effective swath width varies with the amount of oil released per minute. For example, in the case of the PT-17, with a .75 inch outlet, the effective swath width is 50 feet, with a .5 inch outlet it is 32 feet, while with a .25 inch outlet the swath width is reduced to 16 feet.

V. ENTOMOLOGICAL OBSERVATIONS.

A small detachment from the 327th Ferrying Squadron, MATS established a base of operations at Pisa, Italy early in May 1945. In addition to flying and ground personnel the detachment consisted of five (5) A-20's, one (1) PT-17 and one (1) L-5. Three (3) of the A-20's were fitted for dispersing oil larvicide and two (2) for dispersing Paris green dust; in addition, the FT-17, which at the start of the season functioned as a duster, was later converted to an oiler. A description of these oiling planes, which were developed in this theater, together with a discussion of larvicide application has been given in the first part of this report. Unfortunately, due to insufficient trained inspectors as well as numerous setbacks, it has not been possible to carry on detailed entomological investigations. A few observations are available, and are reported here for what they are worth.

The oiling planes commenced operations in the Pisa-Leghorn area on the 5th of June 1945. Ground surveys had been conducted and maps prepared for use by the pilots and for correlating air-plane larviciding with larval collections. The area in question consists of a

veritable network of long canals and interlocking ditches. Many of these waterways are bordered by trees, and telephone and power lines; at frequent intervals the latter cross the canals, all of which tends to make flying at low levels dangerous, and the opportunity exists for a piece of canal near such an obstruction to receive little or no larvicide; likewise gusty winds may deflect portions of the oil stream away from the water surface. In spite of these hazards, it is felt that highly satisfactory results were obtained.

During June and a part of July, reliable entomological records are available which show the effectiveness of the larviciding. On the 3rd of June, Area IV showed seventeen (17) stations positive for anopheline breeding. By the 7th of June, after one treatment by the A-20 of 5% DDT in diesel oil, five (5) stations still remained anopheline positive. After one more spraying, only two stations were positive on the 19th of June, and by the 13th of July all stations were negative. Similar results were obtained in other areas where anopheline larvae had been present. Areas II and VI showed close to 90 reduction of both anopheline and culicine larvae after one month of larviciding by plane. This suggests a cumulative DDT effect.

Late in the season several experimental runs were made by the PT-17 at Grosseto. An extensive canal system exists around Grosseto. Many of the canals were heavily overgrown with horizontal and vertical vegetation, and, at the time of the experiments contained large numbers of both culicine and anopheline larvae. On the 30th of August, 420 gallons of oil containing 5% DDT were dispersed along the canals and ditches in the area, and again on the 4th and 5th of September, 500 gallons were applied.

Larval density has been reported in terms of "Few" (1-5 larvae in 10 dips), "Moderate" (1-3 larvae per dip) and "Abundant" (5-10 larvae or more per dip). Reference is made to Table 6 and accompanying maps for results of larval collections before and after treatment.

It will be noted that the first collections (before treatment) showed that 15 or 54% of the 28 stations visited were mosquito positive (14 or 50% harbored anophelines and 6 or 21% harbored culicines). On the day following the first application of spray, the numbers of positive stations had been reduced to 11 (39%), of which 9 (32%) produced anophelines and 5 (18%) produced culcines; this represents a 36% reduction in anopheline positive stations. Collections were made again on the 6th of September, the day following the second application of DDT larvicide. The number of mosquito positive stations remained the same (11), but the anopheline positive stations had been reduced to 4 (14%) and those harboring culicines had increased to 10 (36%); this represents a 71% reduction of anopheline positive areas over the condition originally existing in the area.

It will also be noted that the degree of larval density varied considerably in the three collections. Some stations, which had few or no larvae in the first collections have been reported as having abundant numbers of larvae at the time of the third collection, although the time interval could not have been much over a week. These results naturally reflect on the efficiency of the oil application, however the thoroughness of the inspectors is likewise open to criticism. The relative ineffectiveness in culicine reduction (64%) as compared with that of the anophelines (71%) is of considerable interest. The fact that the canals were heavily vegetated undoubtedly was a prime factor in decreasing the larvicide's efficiency.

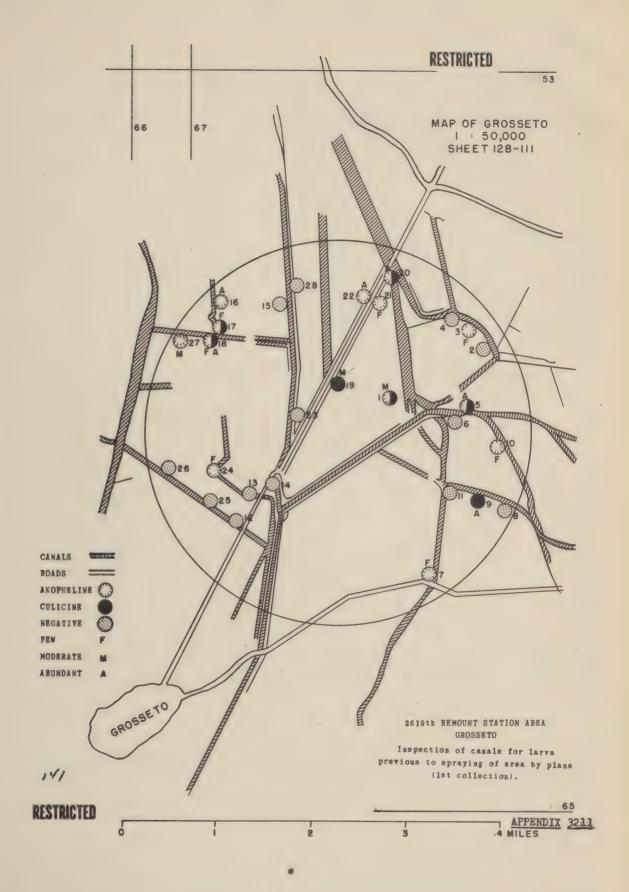
Table 6. Larval Collections after Airplane Larviciding in the Grosseto Area.

AREA	1st COLLECTION	2nd COLLECTION	3rd COLLECTION
62777767	(before treatment) (I		
7	Culex-1st & 2nd instar	Negative	Culex-pupae-Few
-	Moderate	Nogautvo	outex-babae-rem
	Anopheles-all stages		
	Moderate		
. 2	Negative	Negative	Negative
3	Anopheles-all stages	Negative	Negative
	Few		
4	Negative	Negative	Negative
5	Culex-all stages	Culex-all stages	Negative
	Abundant	Abundant	
	Anopheles - all	Anopheles-all stag	es
	stages - Abundant	Abundant	
6	Negative	Negative	Negative
7	Anopheles-1st instar Few	Culex-1st instar-f	ew Culex-all stages-
8	Negative	Negative	Negative
9	Culex-all stages-	Culex-pupae-few	Culex-all stages-
	Abundant		Abundant
10	Anopheles-3rd instar	Negative	Culex-all stages-few
11	Negative	Negative	Negative
11 12 13	Negative	Negative	Negative
13	Negative	Negative	Culex-all stages-
			Abundant
14	Negative	Negative	Negative
<u>14</u> 15	Negative	Negative	Negative

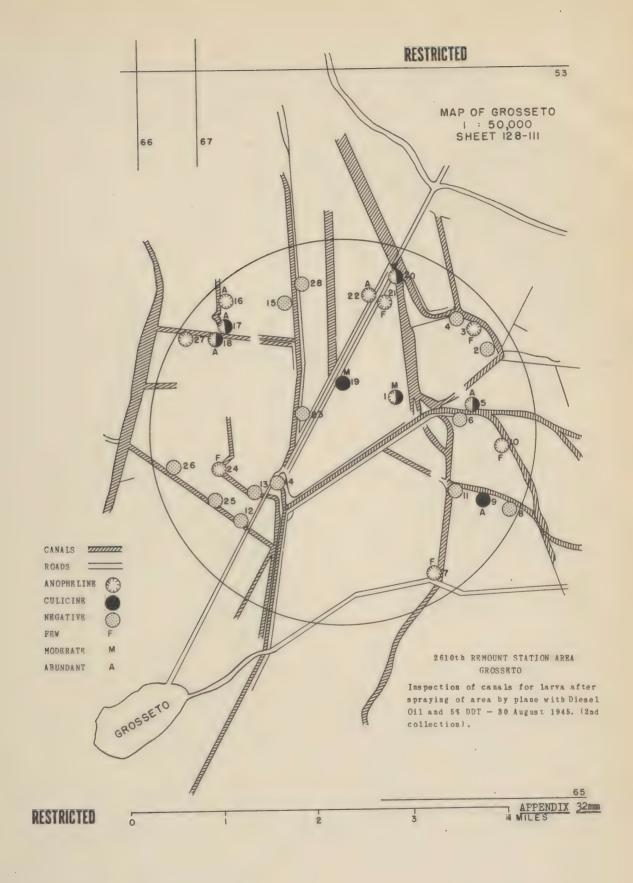
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Table 6. (continued)

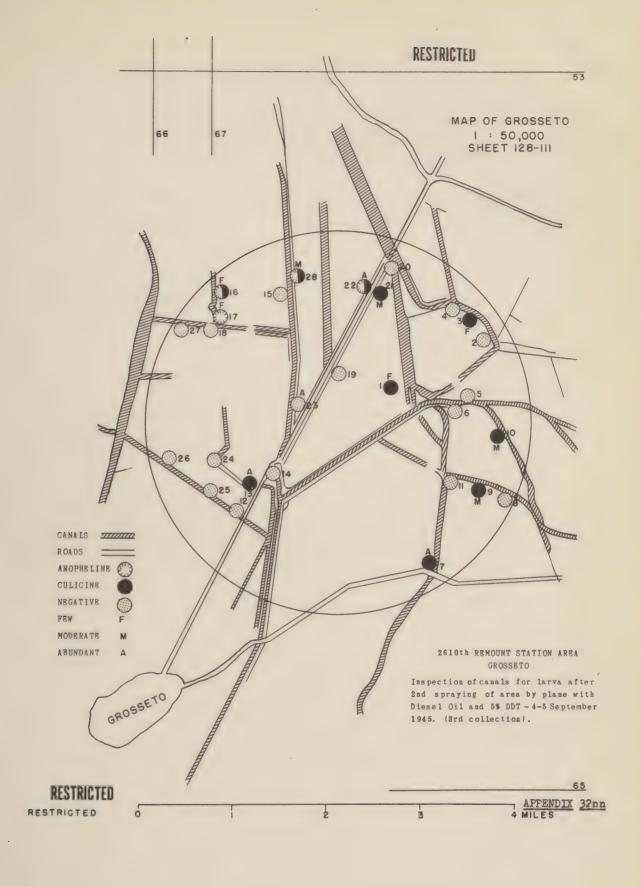
AREA	lst COLLECTION	2nd COLLECTION	3rd COLLECTION
	(before treatment)	(Day after 1st Treat)	(Day after 2nd Treat
16	Anopheles-all stages	Culex-all stages-	Culex-1st & 2nd instar-
	Abundant	Abundant	Few
		Anopheles-all stages	Anopheles-lst instar-
		Abundant	Few
17	Anopheles-all stages	Anopheles-all stages	Anopheles-2nd and 4th
	Abundant	Abundant	instar & pupae - Few
18	Anopheles-1st instar	Anopheles-all stages	Negative
	Few	Abundant	
	Culex-all stages-		
	Abundant		
19	Anopheles-all stages	Anopheles-all stages	Negative
	Moderate	Moderate .	
20	Anopheles-all stages	Anopheles-all stages	Negative
	Moderate	Culex - all stages	
	Culicine-all stages	Abundant	
	Abundant		
21	Anopheles-all stages	Anopheles-all stages	Culex-all stages
	Few	few	Moderate
22	Anopheles-all stages	Anopheles-all stages	Culex-all stages-
	Abundant	Abundant	Abundant
			Anopheles-all stage
			Abundant
23	Negative	Negative	Culex-1st and 2nd
			instar-Abundant
24	Anopheles-all stages	Anopheles-pupae-Few	Negative
	Few		
25	Negative	Negative	Negative
26	Negative	Negative	Negative .
27	Anopheles-all stages	Negative	Negative
	Moderate		
28	Negative	Negative	Anopheles-1st & 2nd
			instar- Moderate
		·	Culex-1st instar-
			Few













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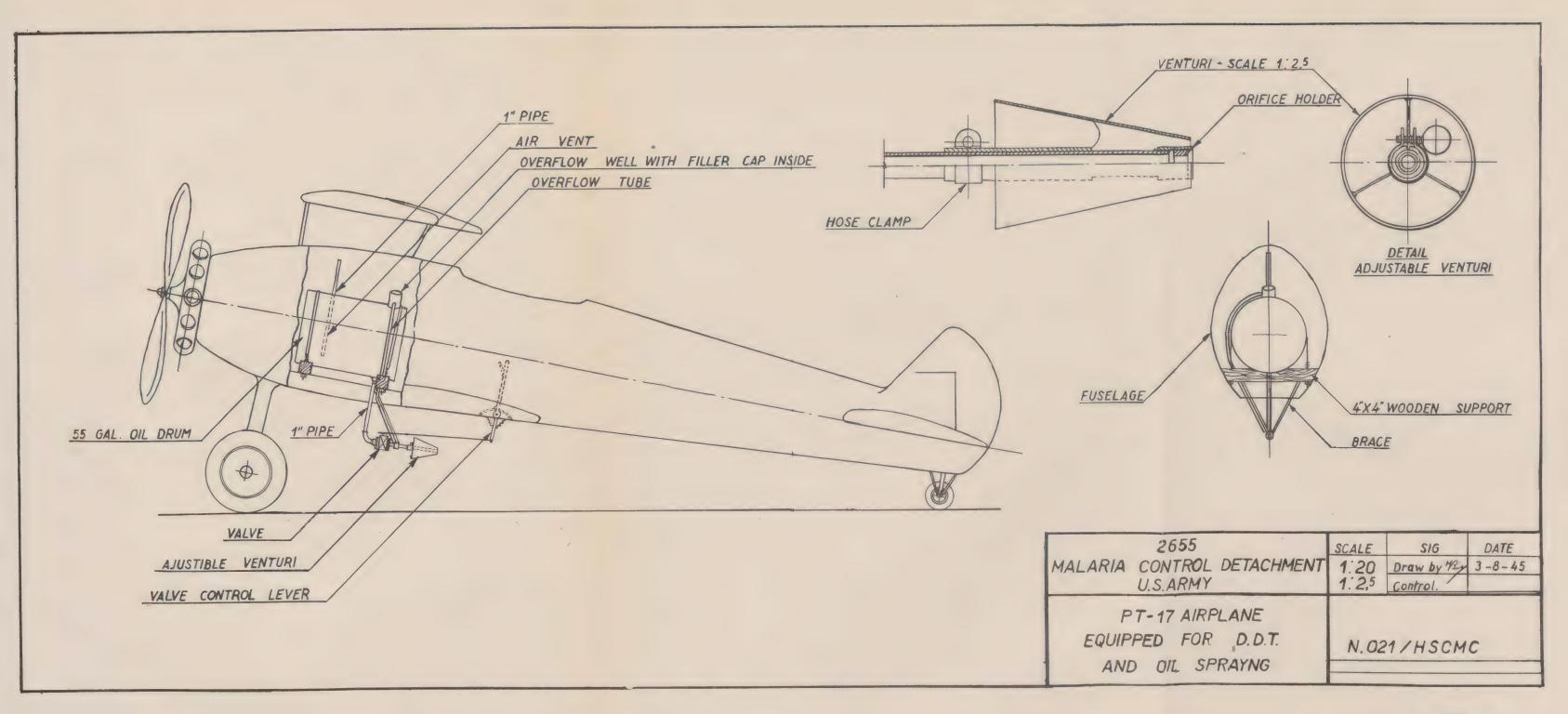
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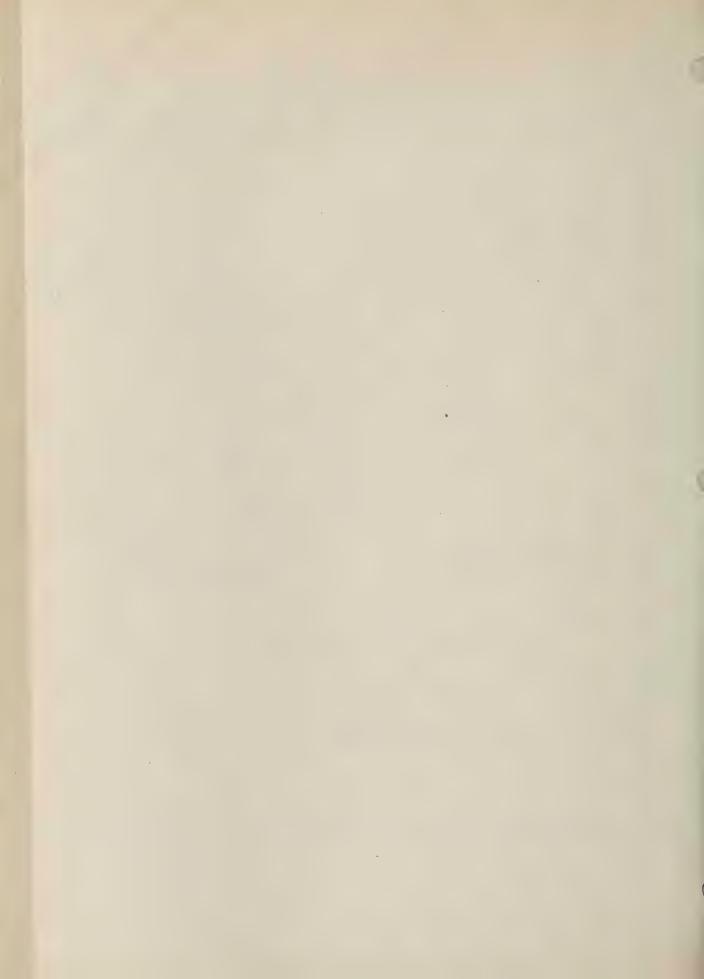
For the gracious cooperation shown by the pilots of the 327th Ferrying Squadron, MATS, Captain Gerald C. Dunfield, Captain Robert E. Gordon, Captain James H. Rowsey, 1st Lts. Chester G. Irwin, Russel W. Priest and Gene H. Sackey in flying the tests and for their many valuable suggestions the writer is sincerely grateful.

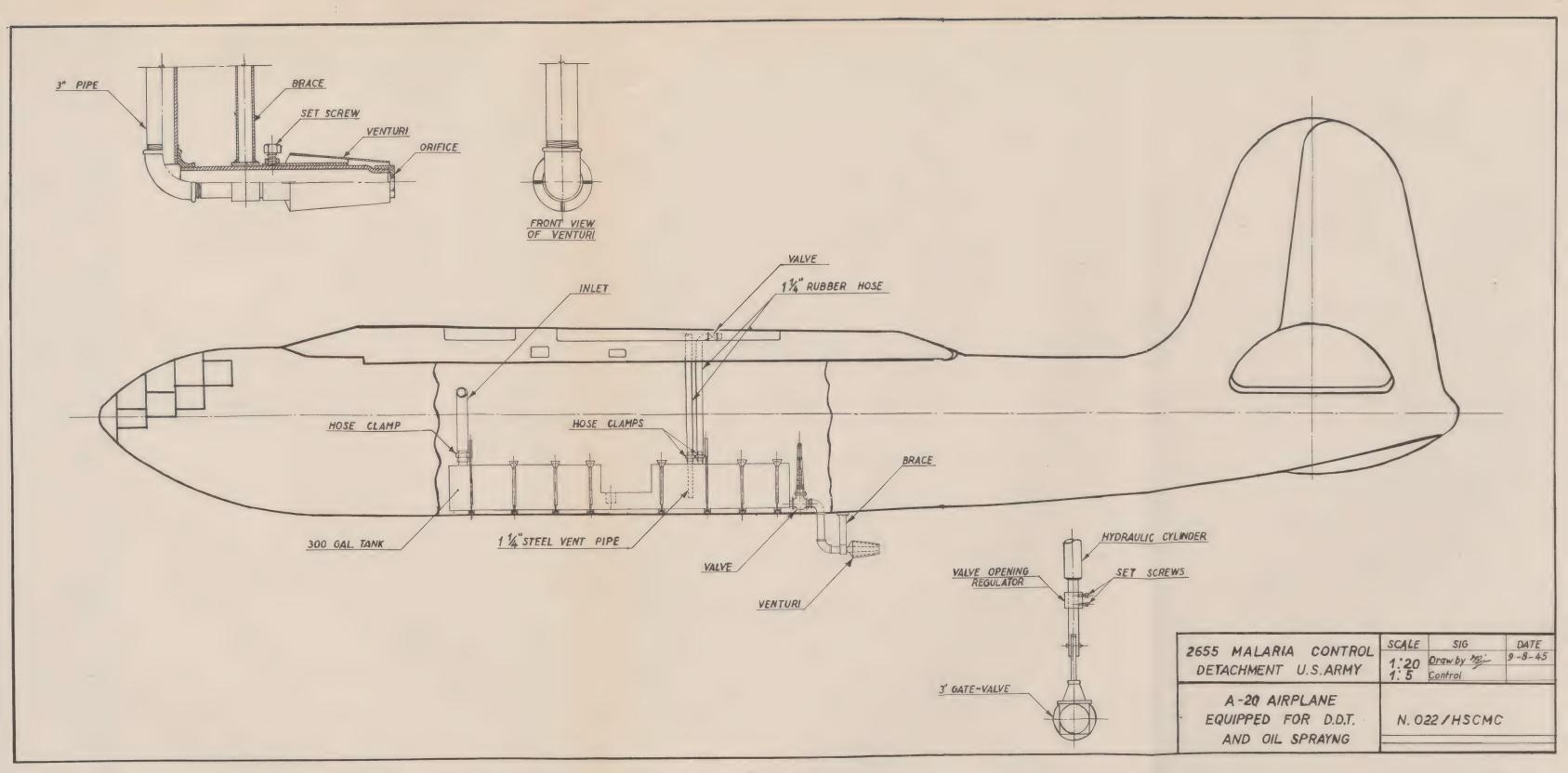
Captain Harold C. Young, Sn.C., and the men of the 134th Malaria Control Detachment very kindly assisted me on many occasions during the progress of the work.

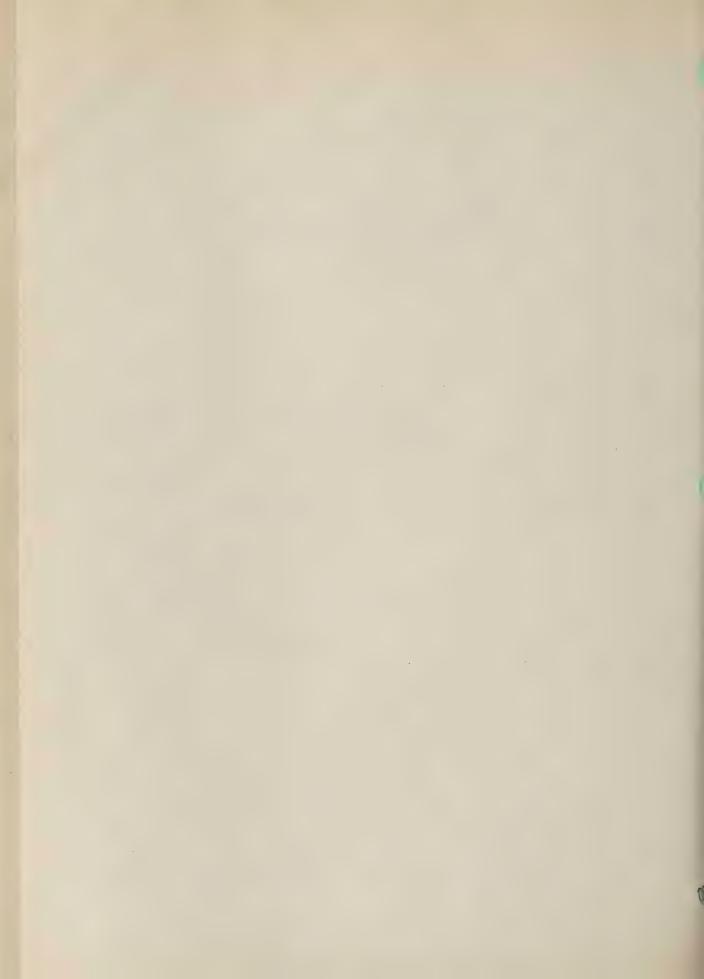
I am indeed indebted to Dr. Louis A. Riehl and Mr. Fred W. Knipe of the Rockefeller Foundation and the Malaria Control Demonstration Unit, Allied Commission, for the valuable technical aid in the construction and testing of the spraying apparatus.

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HEADQUARTERS MEDITERRANEAN THEATER OF OPERATIONS UNITED STATES ARMY APO 512

CIRCULAR)
:
NUMBER Al)

15 March 1945

MTOUSA SAFETY AND ACCIDENT PREVENTION PROGRAM

Circular Number 138 and Section I, Circular Number 145, both this headquarters, 1944, are rescinded and the following substituted therefor:

I -- POLICY

- 1. The MTOUSA Safety Program is designed to eliminate unsafe conditions and unsafe practices which result in injuries or occupational diseases to military personnel, prisoners of war and civilian personnel, or which cause damage to Government or other equipment and property or interrupt military operations.
- 2. a. G-l, MTOUSA is charged with General Staff supervision and the establishment of policies of the MTOUSA Safety Program, including staff supervision of activities of major commands and technical services.
- b. Provost Marshal General MTOUSA is operationally responsible for the MTOUSA Safety Program and charged specifically with:
- (1) Supervision of all MTOUSA agencies engaged in safety activities including:
 - (a) Coordination with the General and Special Staff
 Sections of Headquarters, MTOUSA, in the development of the program.
 - (b) Assembly and analysis of accident statistics for Headquarters, MTOUSA.
 - (c) Procurement and distribution of visual aids, film, posters, publications and other media for the dissemination of safety information and data as facilities permit.
- 3. Commanding Generals of the major commands are responsible for the Safety Program within their respective commands. They will:

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Hq MTOUSA Circular #41 (cont'd)

- a. Designate a qualified safety director who will be known as the Command Safety Director. The duties of the Command Safety Director at installations at which the major command is responsible for the Safety Program will generally include the following:
- (1) Supervising and coordinating all safety activities within the command.
- (2) Assisting commanding officers of subordinate units in selecting unit safety directors, arranging for systematic investigation of accidents involving military and civilian personnel, lending technical engineering assistance and providing posters, films and other safety promotional material as available.
 - (3) Assembling and summarizing accident statistics.
- (4) Representing and advising the commanding general on matters pertaining to safety.
- b. Institute appropriate corrective action at installations whose reports indicate serious trends in accidents or where hazardous conditions are known to exist, determine the adequacy of safety activities and organization, and submit to the installation recommendations when deemed necessary.
- c. Supervise the assembly of information with regard to accidents, submitting reports when and in form as directed by Provost Marshal General. MTOUSA.
- d. Commanding General, Fifth Army, is authorized to exempt combat units from such parts of the program or the reporting system as he deems necessary and to exempt any element of the Fifth Army, when, in his opinion, the requirements of the safety program will interfere with combat operations.
- 4. The commanding Officer of each subordinate unit of major commands will be responsible for the operation of the Safety Program. He will appoint, a unit safety officer and will determine the proportion of such officer's time to be devoted to safety work. There will be but one safety program at each installation; the program will include U.S. Military and Civilian personnel and Italian Military and Civilian personnel.
- a. The duties of the unit safety officer will generally include the following:

Hq MTOUSA Circular #41 (cont'd)

- (1) Establishing and coordinating a program to provide accident controls for all personnel.
- (2) Compiling and maintaining a list of potential and actual safety hazards in and about the unit and making recommendation for the elimination of unnecessary hazards.

II - ACCIDENT REPORTING PROCEDURES

1. Report

- a. Effective 1 May 1945, in the reports covering data for the month of April 1945, the procedures set forth below will govern the reporting of data pertaining to disabling injuries to United States and Italian military personnel and United States and Italian civilian personnel and accidents involving motor vehicles operated by all units of MTOUSA.
- b. Report forms to be used in connection with these procedures are Forms A and B (inclosures 1 and 2), which will be reproduced locally.
- c. Commanding officers will prepare an Individual Injury Report (Form A) for each disabling injury, in duplicate, retaining one report in a file at the unit and forwarding one copy to major command or subordinate command headquarters, as directed, not later than 72 hours after hour of accident. In addition, they will prepare Monthly Accident Summary Report (Form B), in duplicate, and will forward one copy to the commanding general or commanding officer of their respective command to be received there not later than the fifth of the succeeding month.
- d. Commanding generals or commanding officers of major commands, upon the receipt of Monthly Accident Summary Reports (Forms B) will prepare, in duplicate, Monthly Accident Summary Report (Forms B) containing data from all Forms B received, and will forward one copy in time to reach Provost Marshal General, MTOUSA, not later than the 12th of the month following the close of the month to which the data pertains.

2. <u>Definitions</u>

- a. The following definitions will be used by all echelons of MTOUSA:
- (1) Motor vehicle Any self-propelled vehicle used for transporting persons or property, except those vehicles designed exclusively for off-the-highway use.

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Hq MTOUSA Circular #41 (cont'd)

- (2) <u>Motor vehicle accident</u> (See paragraph 18c, AR 850-15) An accident involving a motor vehicle and in which:
 - (a) A claim is made, or
 - (b) Government property is damaged, lost, or destroyed in excess of \$25, or
 - (c) Private property is damaged, lost, or destroyed, or
 - (d) Death or disabling injury results to military or civilian personnel.
- (3) <u>Injury</u> Any injury resulting from accident, damaging or harming the physical structure of the body.
- (4) Disabling injuries (non-battle) are defined in (a) through (d) below. Deaths from natural causes will not be included.
 - (a) Fatality Any loss of life (non-battle) resulting from an injury.
 - (b) Permanent total disability Any injury (non-battle) other than death which permanently and totally incapacitates the injured person from following any gainful occupation. The loss of, or loss of use of, both hands, or both arms, or both legs, or both feet, or both eyes, or any two of the foregoing, suffered in one accident, will be considered a permanent total disability.
 - (c) Permanent partial disability Any injury (non-battle) other than death or permanent total disability, which involves:
 - 1. Complete loss of any member of the body or part thereof or
 - 2. Permanent impairment of any function of any member of the body or part thereof.
 - (d) Temporary total disability Any injury (non-battle) other than death, permanent total disability, or permanent partial disability, which, in the opinion of the doctor, makes it inadvisable for the injured person to return to duty the day following the one on

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Hq MTOUSA Circular # 41 (cont'd)

which the injury occurred, or on some later day. The term "doctor", as used above, is defined as the medical officer or authorized practicing physician whose opinion as to whether an injured person should return, or should have returned, is acceptable to the reporting unit.

- (5) Agency Object or substance which was associated most closely with the injury and which, in general, could have been properly guarded or corrected.
- (6) <u>Unsafe condition</u> Condition of the selected agency which could have been guarded or corrected.
- (7) <u>Unsafe act</u> That violation of a commonly accepted safe procedure which resulted in the accident.
- (8) <u>Total Man-days (military)</u> Add the daily strength for duty reports for the period and divide the total by the number of days in the period.
- (9) Total Man-hours Worked (Civilian) The total of all hours worked in a calendar month by all civilians engaged in the normal operation of the unit.

3. Instructions

- a. Disabling injuries will be reported in the calendar month in which it is learned that the injury resulted in a disability, not the month in which the injury occurred. When a nondisabling injury develops into a disabling injury at a later date, it will be reported as a disabling injury and included in the current month's report. A disabling injury will be included in an accident frequency rate only once.
- b. A motor vehicle accident will be included in the experience for the month in which any of the four factors stated in paragraph 2a (2) becomes known to the unit.
- c. If no disabling injuries or no motor vehicle accidents occurred or became known to the unit during the month, a Monthly Accident Summary will be submitted giving exposure date and showing zero accident experience.

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Hq MTOUSA Circular #41 (cont'd)

d. The officer whose signature appears on the reports will be responsible for the accuracy and reliability of data contained therein.

BY COMMAND OF LIEUTENANT GENERAL MCNARNEY:

OFFICIAL:

GEORGE D. PENCE Major General, GSC Chief of Staff

/s/C. W. Christenberry C. W. CHRISTENBERRY Colonel, AGD Adjutant General

2 Incls: Forms "A" & "B"

DISTRIBUTION:
Z
25 - G-1 (A) extra

FORM "A"

REPORT OF LOST TIME INJURY (MTOUSA)

This form to be prepared by the Safety Officer in cooperation with the Surgeon. Forward one copy to major command headquarters, or subordinate headquarters as directed, not later than seventy-two hours after hour of accident.

LOCA- TION	(Unit Designation) APO Name of Commanding Officer
THE	Name Sex Age Length of Service or Employment Race A.S.N. or Employee No. Principal Duty M.O.S. No.
TIME AND PLACE	Date of Accident Hour *Place of Accident Name of Witness Person in charge or responsible at time of accident *As unit area, highway, ball field, motor park, air field
THE	DESCRIBE IN DETAIL HOW ACCIDENT OCCURRED: (Use diagram where useful)
DIAGNOSIS AND DISPOSITION	Nature of Injury and part of body affected. Describe clearly
CAUSE	What machine, machine part, or other physical agency was involved in the accident? (UNSAFE CONDITION) Was the failure of any person wholly or partially responsible for accident, and how? (UNSAFE ACT)
CORRECT- ED ACTION	What has been done to prevent a similar accident?
REPORT M	ADE BY: APPROVED BY: NOTE: Use other side if necessary to expand details.

Inclosure #1

FORM "B"

MONTHLY ACCIDENT SUMMARY (MTOUSA)

one cop	y to	ed at end of each month from tabulation of Form A reports; 1. MONTH- be forwarded to major command headquarters, or subordinate, , as directed prior to the fifth of succeeding month.
		2. YEAR
LOCA- TION	3. 4. 5. 6.	Unit DesignationAPO
EXPO- SURE	7. 8.	Total Man-days (military) U.S. Ital. Ital. Ital. Ital.
INJURY RECORD	9. 10. 11. 12. 13.	TYPE INJURY NO. OF INJURIES (MILITARY) U.S. ITAL Fatalities Permanent Total Fermanent Partial Temporary Total Total Injuries
RATE:	14.	Military Accident Rate (M.A.R.) U.S. ITAL Civilian Frequency Rate (C.F.R.) U.S. ITAL
MOTOR VEHICLE RECORD	16. 17. 18. 19.	Total Number of Motor Vehicles Total Miles Driven Number of Accidents Motor Vehicle Frequency Rate (M.V.F.R.)
PREPARE	D BY:	DATE Signature of C.O.

FORMULAS ON REVERSE SIDE

DATE

Military Accident Rate (M.A.R.) is the number of disabling injuries per 100,000 man-days.

M. A. R. - No. of Disabling Injuries x 100,000

Number of Man-days

Civilian Frequency Rate (C.F.R.) is the number of disabling injuries per 1,000,000 man-hours worked.

C. F. R. - No. of Disabling Injuries x 1,000,000

Number of Man-hours worked

Motor Vehicle Frequency Rate (M.V.F.R.) is the number of accidents per 100,000 miles driven.

M. V. F. R. - No. of Accidents x 100,000

Number of miles driven





